GYC-1000 Training

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1. Safety

Operators Manual

Classifications

Safety

Warning

2. Outline(Operators Manual)→Power、Laser Head、Wave Length

Principles (Operators Manual)

3. Specifications

Operators Manual (9-1,9-2)

Power : 50mW-1700mW

Time : 0.01sec.-3.00sec.

Wavelength :532nm

Laser Power :2.5W @ 11.0-15.0A

Beam Diameter:30um-40um

Transmittance of fiber:90%

4. Operation

Control box

5. Installation : Slit、Delivery、Check Power

a. 100V / single phase

b. Check Slit Lamp

confirm the adjust bar position

Confirm the aiming focus on 500um and 50um

Coaxial between 50um and 500um

c. Dip switch function

e. Parameter settings(Technical Bulletin/ Rom Version)

f. Check Focus of Aiming Beam

g. Check power by burn paper

Spot Size	Power	Time	Result
200um	200mW	0.2sec	Check burn spot over 80%
50um	1000mW	0.02sec	Laser pass through on second shoot

h. Check actual power at delivery end by power meter.

*Need to perform the fiber alignment, over power and power check.

*You must use electrical static protect service kit

*Before you install the fiber optics, you must clean the fiber surface.

Fiber alignment

Service Manual 7.5.5

Over Power

Service Manual 7.6.3

Power check

Service Manual 7.6.1

7. Shutter Unit

8. Optical Axis for Laser Beam and coaxial between aiming beam and laser beam.

9. Output Power

Settings

*Dip switch 1, 2 and 4 up

*Display 1700mW

*Remove the fiber optics

Check the Output Power at end of shutter unit.

Over 2.4W

10. Fiber Alignment

See Service Manual

Note: Loosen set screw

Mark the focus lens holder before remove

Rotate the fiber connector after align

Difference of X-Y stage on GYC-1500 and GYC-2000

11. Adjusting the Light Control

See service manual

Power calibration for each delivery by parameter

Check the output power by Power Meter

12.Adjusting the over power

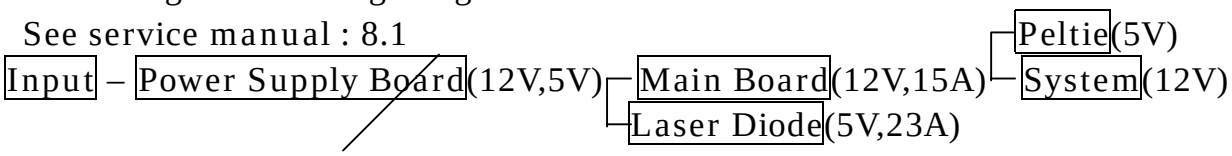
See service manual : Page 5-9

*Note - Set the dip switches 1,2 and 5

- Dip switch Pack->See Service Manual Page 7-8

13. Block Diagram / Wiring Diagram

See service manual : 8.1



14. Replacement

Master Board

Power Supply Board

15. Trouble shooting

Parameters : See Service Manual

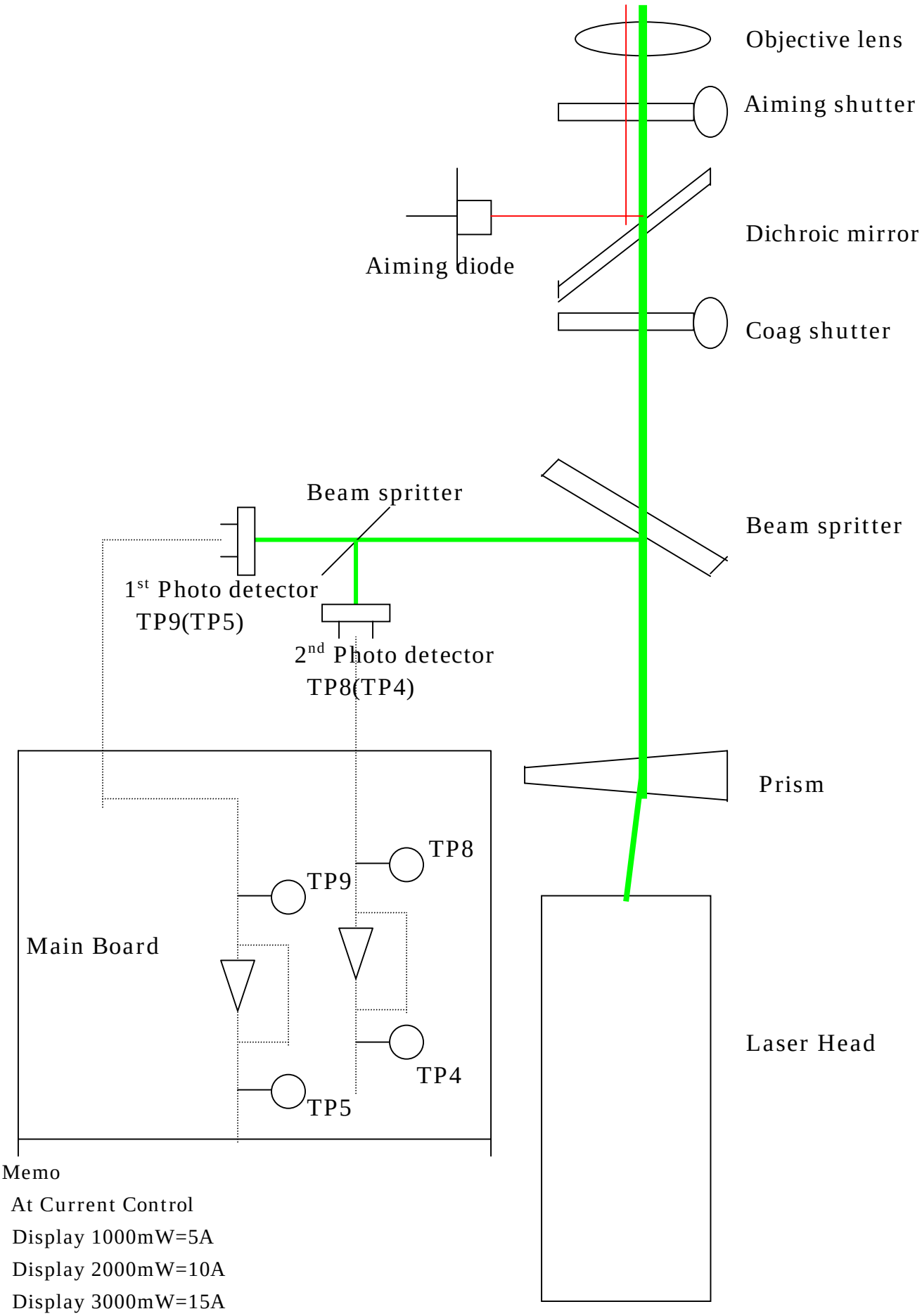
Error Code : See Service Manual

Inter lock : See Service Manual

Other indications : See Service Manual

Check the laser head condition by service mode

Power down



Memo

At Current Control

Display 1000mW=5A

Display 2000mW=10A

Display 3000mW=15A

Display 4000mW=20A

GYC-1000 TECHNICAL BULLETIN

（技 術 公 報）

		NUMBER	17164-007E/007J
配 布	SUBJECT （主題）:	S/N	From 10001
営 業	Servicing information	DATE	May 24, 2004
✓ N.Inc	(Compatible with software version 1.02)	BY	M. Kawai
✓ 国 際		APPROVED BY	中村
✓ 品 管	☐ MODIFICATION （変更） ■ INFORMATION （情報）		中尾
X1 製造	☐ PRIORITY （最優先実行） ■ INFORMATION ONLY （情報のみ） ☐ INFORMATION ONLY （マニュアルアップグレード）		
✓ サービス			
✓ 技 術	☐ AS NECESSARY （必要時実行） ☐ CHANGE NOTICE （変更通知） ☐ APPLICATION NOTE （アプリケーションノート）		
✓ N.SA			
✓ 管 理			

This technical bulletin (TB) is prepared as information for servicing the GYC-1000.

This document is revised from TB 17164-001E/001J.
Main change: Addition of the L7 (GYC-4) corresponding to Ver. 1.02

This TB includes the following items:

1. Error code table
2. Interlock code table
3. Other indications
4. Setting method of DIP switches
5. DIP switch table
6. Special functions which can be set from the outside
7. Program change history
8. Setting method of system parameters
9. System parameter table
10. Parameter setting values when installing the GYC-1000 (Addresses 14 and 93)

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1. Error code table

Err	Symptom	Cause	Remedy
1	Operation failure of the coagulation shutter	Failure of the movement or position of the coagulation shutter	Check the shutter movement. Check the position of the sensor.
2	Operation failure of the motorized protective filter	Failure of the movement or position of the motorized protective filter	Check the protective filter movement. Check the position of the sensor. Check the DELIVERY connector. Check the delivery parameter setting.
3	Operation failure of the safety shutter	Failure of the movement or position of the safety shutter	Check the shutter movement. Check the position of the sensor.
10	Failure of the laser	Degradation of the green laser	Replace the laser. Check the laser control signal cables, P116 to P119.
13	Failure of the L/D driving circuits	Failure of the L/D current driving circuits (Tr1, 2)	Check and replace Tr1 and 2.
15	Unstable power output	Unstable power output of the green laser	Perform under power adjustment again.
20	Failure of the L/D thermal control	Failure of the thermal control part of the L/D	Break between the LD sensor and P123 Failure of the BA01 control circuit
21	Failure of the green laser head thermal control	Failure of the thermal control part of the green laser head	Break between the LH sensor and P123 Failure of the BA01 control circuit
53	Failure of the trigger signal circuit	Failure of the trigger switch or break in the cable	Check whether the foot switch cable breaks. Readjust the micro switch position.
54	Failure of the fiber-optic signal circuit	Failure of the fiber-optic switch or break in the cable	Reconnect the fiber-optic cable plug. Check and adjust the position of the micro switch.
55	Failure of the protective filter signal circuit	Failure of the protective filter sensor, break in the cable or setting mistake	Reconnect the cable plug of the delivery unit. Check and adjust the position of the protective filter sensor.
90	Failure of the program data	Contents of ROM are overwritten.	Replace the CPU.
91	Failure of the EEPROM data	Contents of EEPROM are overwitten.	Cancel the error and reinput the data.
93	Data error	Failure of the memorized data	Cancel the error and reinput the data.
94	KEYLOCK error	Improper operation of the program	Replace the CPU.
95	SUB CPU error	Failure of the SUB CPU	Replace the SUB CPU.

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2. Interlock code table

Interlock No.	Symptom	Cause	Remedy
2.7	Over power	Excessive power output of the laser	• Readjust over power adjustment. • Break in P118 • Failure of BA01
4.7	Overheating of the system	Overheating inside the system	• Turn the system off and cool it down about one hour.
6.3	Remote interlock OFF	The REMOTE connector is not connected or the remote interlock switch is open.	• Connect the REMOTE connector.

3. Other indications

Misoperation indications

When each switch is mistakenly operated, the following abbreviated indication appears on the TIME display.

A.P.·····When the STATUS switch is pressed while the aiming beam is off.
→ Turn the aiming beam on.

F.S.·····When the AIMING switch is pressed while the fiber-optics cable is not connected.
→ Connect the fiber-optics cable to the main body.

S.U.·····When the AIMING switch is pressed while the delivery unit or its laser mirror is not placed at the position where laser emission is possible.
→ Verify the position of the delivery unit or its laser mirror.

S.S.·····When the foot switch is pressed while the STATUS swtich shows the STANDBY mode.
→ Press the STATUS switch to set the system in the READY mode.

P.F.·····When the foot switch is pressed while the protective filter is not inserted.
→ Insert the protective filter.
In the same color aiming beam option, when the AIMING switch is pressed while the system is connected to the delivery unit without the motorized protective filter.
→ Connect the delivery unit with the motorized protective filter to the system.

4. Setting method of DIP switches

The table below shows the functions of the DIP switches (SW1) of the GYC-1000. Normally, all the DIP switches are set to the ON position. Setting the switch to the OFF position activates each function.
The DIP switches are on the display board inside the control box.
NOTE) After servicing, set all the switches to the ON position. If any switch is still set to the OFF position, D.P. (Decimal Point) appears on the COUNTER display.
When in the ON position: [1 2 3 4] When in the OFF position: [1. 2. 3. 4.]

5. DIP switch table

Number	Function	Details
1	Interlock cancel	Cancel the detection of the interlock. (However, the hardware interlock circuit stops laser emission at the time of INTLK.)
2	Error cancel	Cancel the detection of the error.*
3	Not used	
4	Switch between the Current and Light modes	Switch the laser power output mode between the current control (when OFF) and light control (when ON).
5	Continous emission mode	Possible to set the laser exposure time to continuous (Continous mode) at the maximum exposure time setting.
6	Parameter setting mode	Possible to set each parameter.
7	Not used	
8	Service mode	Display the input current to the laser head.

*NOTE) Even though error detection is canceled, Err13, Err20, and Err21 occur in order to prevent laser misemission and degradation.

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6. Special functions which can be set from the outside

Function	Setting method
Adjustment of each laser power output	Setting is possible by turning the key switch to the ON position while pressing the AIMING (V) + AIMING (Λ) + STATUS switches. After the system starts up, parameters are displayed. Change the following addresses to adjust each laser power output. *NOTE) The addresses are limited between 17 and 29. Green laser beam power output: Offset adjustment Address 18 Gain adjustment Addresses 20 to 29 (depending on the delivery unit) Aiming beam power output: Offset adjustment Address 19 Gain adjustment Address 17
Historical records of the system • Indication of the total number of shots (× 1000 shots) • Error record • Interlock record	Setting is possible by turning the key switch to the ON position while pressing the INTVL + STATUS switches. • Total number of shots: Number indicated on the POWER display × 1000 shots • Last Error No. • Last Interlock No.
Emergency mode: (The laser emission becomes possible even when the setup detection signals of the protective filter and delivery unit are improper.) *When using the manual protective filter	Setting is possible by turning the key switch to the ON position while pressing the TIME (V) + TIME (Λ) + STATUS switches. NOTE) This function shall be used only when the operation cannot be continued due to a break in the signal wire etc. Instruct the user to verify the protective filter and setup of the delivery unit.

* Settings above are canceled after the key switch is turned to the OFF position. When the key switch is turned to the ON position again, the system returns to the normal functions.

7. Program change history

* It is not necessary to perform special operation when replacing the ROM. Be sure to use a same version of the MASTER ROM (17164-E150) and SUB ROM (17164-E160.)

Ver. 1.00 (S/N 10001 to 10098)
First version

Ver. 1.01 (S/N 10099 to 10221)
Details
- Correction of the fiber correction factors
- Change of the timing to check the power output when it rises
- Change of the timing to turn the laser off when the manual protective filter is used
- Change of the LD and SHG thermal control methods

Ver. 1.02 (From S/N 10222)
Details
- Change of the timing to write the error record in the EEPROM when any error occurs
- Change of the program for adjusting the MASTER board
- Change of the communication method with the MASTER ROM when Err95 occurs
- Corresponding to the L7 (GYC-4)

* It is possible to use the L7 (GYC-4) delivery unit by using the program of Ver. 1.02. When using the L7 (GYC-4) delivery unit, perform the following parameter settings.
- Address 14: 01 (Setting of the protective filter detection circuit)
- Address 91: 01 (Indication setting of the spot size of 990 μm)
- Address 93: 01 (Setting of the motorized protective filter)

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8. Setting method of system parameters

- Turn the control box upside down, the gray cap (ϕ25) is on the lower side of the control box. Pry the cap open by inserting the tip of a clip into one of the two holes around the cap.
- Set No.6 of the DIP switch (SW8) on the display board in the control box to the OFF position.
- When the switch is set to the OFF position, parameters appear on the following displays.
  Address: TIME display on the control box
  Indication: COUNTER and SPOT SIZE displays on the control box
  Initial value or parameter value: POWER display on the control box
- Press the TIME △ or ▽ switch on the control box to indicate the address to be changed/set.
- Press the POWER △ or ▽ switch to change/verify/set the parameter value.
- Press the RESET switch and verify that short beep sounds are heard. (Completion of change/setting)
- Return No.6 of the DIP switch (SW8) on the display board to the ON position.

NOTE1) It is necessary to turn the key switch to the ON position again except when the laser power output is corrected or the timing to close and open each shutter is changed.

NOTE2) If the system is turned off while No.6 of the DIP switch (SW8) is set to the OFF position (after the parameter is changed, the parameter is still indicated on the display), Err91 (Failure of the EEPROM data) may appear at the next startup. Be sure to turn the system OFF after setting No.6 of the DIP switch to the ON position.
If Err91 appears at the restart, set No.2 of the DIP switch (SW8) to the OFF position and restart the system. Then, set the parameter again according to the setting method of the system parameter.

9. System parameter table (Ver. 1.02)

Address	Indication	Initial value	Contents
1	AdJ	00	Control of the adjustment mode 00: Normal mode 01: Adjustment mode
2	AL on	01	Control of the laser shot sound 00: No sound 01: Sound
3	dEL	00	Setting of the delivery unit
4	cnt dn	10	Countdown timer
5	to ctr	00	Total counter operation stop 00: Count 01: Stop
6	n-A	00	Not used
7	oFF rdy	02	Auto-OFF of READY (minute) 00: Not become OFF
8	ctr rSt	00	Memory of the counter value 00: Memory 01: Clear
9	LAS rSt	00	Memory of the initial value 00: Memory 01: Clear
10	idL UP	00	Offset of the idle current for the L/D
11	SSt Cot	00	Operation mode of the coagulaion shutter 00: In synchronization with the READY switch 01: In synchronization with the foot switch
12	SEL 0	00	0 indication on the TIME display 00: Small letter 01: Capital letter
13	n-A	00	Not used
14	PF2	01	Setting of the motorized protective filter 00: Single system (other than below) 01: L7 dual system (from S/N 53001, *See P.11 and 12) 08: K7 dual system (from S/N 73001, *See P.11 and 12)
15	tr2	00	Input switch of the trigger switch 00: Two circuits 01: One circuit
16	2dl	200	Waiting time after READY Value × (10 msec)
17	AdJ L-d	100	Soft gain of the aiming beam
18	oFs EnE	120	Soft offset of POWER 100 = ±0
19	oFS L-d	104	Soft offset of the amiming beam
20	SL13. Pr	120	POWER correction factor for 130SL
21	SL16. Pr	117	POWER correction factor for SL1600
22	dEr Pr	100	POWER correction factor for DERMA.
23	dEL1. Pr	100	POWER correction factor for other delivery units
24	Endo Pr	100	POWER correction factor for the endophotocoagulation delivery unit
25	dEL2. Pr	100	POWER correction factor (spare)
26	bio Pr	100	POWER correction factor for the binocular indirect ophthalmoscope delivery unit
27	HAAG Pr	120	POWER correction factor for the HAAG delivery unit
28	yc. cbPr	115	POWER correction factor for the combination delivery unit
29	n-A	100	Not used

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Address	Indication	Initial value	Contents
30	100 Fib	100	Fiber correction factor for 100 mW
31	200 Fib	100	Fiber correction factor for 200 mW
32	300 Fib	100	Fiber correction factor for 300 mW
33	400 Fib	100	Fiber correction factor for 400 mW
34	500 Fib	100	Fiber correction factor for 500 mW
35	600 Fib	100	Fiber correction factor for 600 mW
36	700 Fib	100	Fiber correction factor for 700 mW
37	800 Fib	100	Fiber correction factor for 800 mW
38	900 Fib	100	Fiber correction factor for 900 mW
39	1000 Fib	100	Fiber correction factor for 1000 mW
40	1100 Fib	100	Fiber correction factor for 1100 mW
41	1200 Fib	100	Fiber correction factor for 1200 mW
42	1300 Fib	100	Fiber correction factor for 1300 mW
43	1400 Fib	100	Fiber correction factor for 1400 mW
44	1500 Fib	100	Fiber correction factor for 1500 mW
45	1600 Fib	100	Fiber correction factor for 1600 mW
46	1700 Fib	100	Fiber correction factor for 1700 mW
47	1800 Fib	00	Fiber correction factor for 1800 mW
48	1900 Fib	00	Fiber correction factor for 1900 mW
49	2000 Fib	00	Fiber correction factor for 2000 mW
50	ti Lo	01	Minimum value of the photocoagulation time (0.01 sec)
51	ti Hi	300	Maximun value of the photocoagulation time (3.00 sec)
52	coAG ti	8	Correction factor of the photocoagulation time (1: 1.0 msec)
53	rEP ti	75	Correction factor of the repetition time (1: 1.0 msec)
54	oP SS	0	Time from turning the laser on to opening the shutter (1: 1.0 msec)
55	Adjin27	20	Adjustment of the over power (gain) %
56	OFSin27	90	Adjustment of the over power (offset) 100 = ±0
57	tiin27	5	Start time of the over power check (1: 1.0 msec)
58	AdJ Er15	20	Adjustment of Err15 (gain)
59	OFS Er15	200	Adjustment of Err15 (offfset) 100 = ±0
60	Lo P	05	Minimum value of the photocoagulation power output (Value × 10 mW)
61	Hi P	170	Maximum value of the photocoagulation power output (Value × 10 mW)
62	Hi Ldc	200	Maximum value of the LD current (0: 0A 250: 7 A)
63	Hi LHc	200	Maximum value of the LH current (0: 0A 250: 3 A)
64	Ldt Sb	10	Setting value of t. CAL (°C)
65	Ldt St	250	Setting temperature of the LD (°C)
66	LHt St	250	Setting temperature of the LH (°C)
67	Ldt Sb	12	Fluctuation of the L/D temperature
68	LHt Sb	12	Fluctuation of the L/H temperature
69	Fan St	128	Operational temperature of the fan (128: 25 °C /0: OFF 250: ON)

Address	Indication	Initial value	Contents
70	oP PF	01	Return time of the protective filter (1: 1.0 msec) 00: In synchronization with the STATUS switch 01 to 250: In synchronization with the foot switch (Set time of OPEN: 20 msec to 5 sec)
71	oP SH	50	Waiting time of the shutter OPEN (1: 1.0 msec)
72	cL SH	25	Waiting time of the shutter CLOSE (1: 1.0 msec)
73	ti P.F.	15	Waiting time of the protective filter (1: 10.0 msec)
74	GrA. P.F.	05	Correction factor for the motorized protective filter in the same color aiming beam (1: 1.0 msec)
75	P.S.onti	20	Waiting time until the 5 V power supply for the laser head starts up (1: 1.0 msec)
76	n-A	00	Not used
77	n-A	00	Not used
78	n-A	00	Not used
79	LD OFF	00	Current detection limit at LD OFF
80	50uSL16	110	50 µm (SL-1600/30SL)
81	50uSL13	110	50 µm (SL-130)
82	50uHAAG	105	50 µm (HAAG)
83	n-A	100	Not used
84	n-A	100	Not used
85	Lo ATT	180	Not used
86	Hi ATT	180	Not used
87	n-A	100	Not used
88	CAL Pr1	100	CAL output correction 1 (Not used)
89	CAL Pr2	100	CAL output correction 2 (Not used)
90	rE Spot	100	Adjsutment of the spot size (Not used)
91	SS 1000	00	S.S. 1000 um indication 00: 500 um 01: Only L7 is 1000 um indication. 08: Only K7 is 1000 um indication.
92	Ld cL	200	Limit value of the LD current (10 = 1 A)
93	Std cot	00	Setting of the motorized protective filter (*See P.11 and 12) 00: Manual 01: L7 02: EPS 08: K7 When selecting several delivery units, add each setting value. Ex.) 03: L7 + EPS 10: K7 + EPS

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Address	Indication	Initial value	Contents
94	Gr-A	00	Not used
95	Gr-A Pr	45	Not used
96	Lo Gr-A	50	Not used
97	n-A	00	Not used
98	n-A	00	Not used
99	Fot Pr	00	0: Prohibit 1: Premit
100 197	n-A	00	Not used
198	no uP	00	ROM update
199	in EEPr	00	Initial setting of EEPROM 99: Initial setting

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10. Parameter setting values when installating the GYC-1000 (Addresses 14 and 93)

Motorized: Motorized protective filter, Manual: Manual protective filter
Number at upper stand: Parameter value of address 14
Number at lower stand: Parameter value of address 93
* When using the L7 (GYC-4), enter "1" in Adderss 91 separately.

Parameter setting value of one delivery unit

Delivery	Parameter setting value
L7 (GYC-2) Motorized (from S/N 52001)	00 01
L7 (GYC-2) Motorized (from S/N 53001)	01 01
L7 (GYC-4) Motorized (from S/N 440001)	00 01 Add 91: 01
K Manual (from S/N 22001)	00 00
K Manual (from S/N 23001)	08 00
K Motorized	08 08
C Manual	00 00
AG Manual	00 00
AS Manual (from S/N 12001)	00 00
AS Manual (from S/N 13001)	08 00
AS Motorized	08 08
EPS Motorized	00 02
EPS Manual	00 00
BIO	00 00
MO	00 00

Parameter setting value when combining two delivery units

Delivery① \ Delivery②	EPS Motorized	EPS Manual	BIO	MO
L7 (GYC-2) Motorized (from S/N 52001)	00 03	00 01	00 01	00 01
L7 (GYC-2) Motorized (from S/N 53001)	01 03	01 01	01 01	01 01
L7 (GYC-4) Motorized (from S/N 440001)	01 03 Add 91: 01	01 01 Add 91: 01	01 01 Add 91: 01	01 01 Add 91: 01
K Manual (from S/N 22001)	00 02	00 00	00 00	00 00
K Manual (from S/N 23001)	08 02	08 00	08 00	08 00
K Motorized	08 10	08 08	08 08	08 08
C Manual	00 02	00 00	00 00	00 00
AG Manual	00 02	00 00	00 00	00 00
AS Manual (from S/N 12001)	00 02	00 00	00 00	00 00
AS Manual (from S/N 13001)	08 02	08 00	08 00	08 00
AS Motorized	08 10	08 08	08 08	08 08
EPS Motorized			00 02	00 02
EPS Manual			00 00	00 00
BIO	00 02	00 00		00 00
MO	00 00	00 00	00 00	

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Examples of the setting
- L Motorized (from S/N 53001) + EPS Motorized: Set "01" in address 14 and "03" in address 93.
- K Manual (from S/N 23001) + EPS Manual: Set "08" in address 14 and "00" in address 93.

Explanation of the initials
L: ZEISS SL-130 delivery unit L7(GYC-2), L7(GYC-4)
K: NIDEK SL-1600, SL-1800 delivery unit K*(GYC-2), J1(GYC-2), C*(GYC-2), C*(GYC-4)
C: Combination delivery unit GYC2SZ-3
AG: HAAG attachable delivery unit GYC2SG-2
AS: ZEISS 30SL attachable delivery unit GYC2SZ-1
EPS: Endophotocoagulation delivery unit EPS-22, 26
BIO: Binocular indirect ophthalmoscope delivery unit GYC2BO-1, GYC4BO-2
MO: Ocellar indirect ophthalmoscope delivery unit GYC2MO-1

Explanation of S/N
- The parameter setting of address 14 depends on the number of the filter position detection switches (single or dual detection system) in the protective filter.
- The S/N is indicated on the label affixed to the bottom side of the coagulation unit (the surface where the coagulation unit is attached to the slit lamp tubes).
- As for the S/N, see pages 1 and 2 in TB 17162-013E/013J of the GYC-2000.

GYC-1000 TECHNICAL BULLETIN

（技 術 公 報）

		NUMBER	17164-006E/006J
配 布	SUBJECT （主題）: Countermeasure against INTLK4.7	S / N	—
✓ 営 業		DATE	May 19, 2004
✓ N.Inc		BY	S. Matsuura
✓ 国 際		APPROVED BY	中村、中尾
✓ 品 管	☐ MODIFICATION （変更）	■ INFORMATION （情報）	
X1 製造	☐ PRIORITY （最優先実行）	■ INFORMATION ONLY （情報のみ）	☐ MANUAL UPDATE （マニュアルアップグレード）
✓ サービス	☐ AS NECESSARY （必要時実行）	☐ CHANGE NOTICE （変更通知）	☐ APPLICATION NOTE （アプリケーションノート）
✓ 技 術			
✓ N.SA			
✓ 管 理			

We have received the complaint concerning INTLK4.7 that occurs due to overheating inside the GYC-1000.
The design has been already changed as the countermeasure. However, this change will be actually reflected in the product from June 2004.
When the same complaint is made in the product with which the design change is not made, perform the countermeasure described below.

Prepare the countermeasure part beforehand.
* At this time, there is not stock of the part yet. We will have it in stock from June 2004.
  - **17164-E117 (Thermal reed switch, Model: M-TRS5-50B)** ... 1 piece/unit

Countermeasure method

1. **Change the thermal switch on 17164-BA01.**
   In the present status, the thermal switch that is turned off at a temperature of 45°C (17164-E110) is used. Change the switch to a new one that is turned off at a temperature of 50°C (17164-E117).
   [Reason]
   INTLK4.7 occurs when the temperature inside the system rises and the thermal switch is turned off.
   As the temperature set point is changed from 45°C to 50°C, INTLK4.7 does not occur easily.
2. **Change the limit temperatures of the laser diode (LD) and SHG crystal (SHG) in the laser head (LH) from ±4°C to ±3°C.**
   Change the parameter values of Addresses 67 and 68 from 15 to 12.
   [Reason]
   As the set point of the thermal switch changes to 50°C, the temperature of the LH itself rises. The temperatures of the LD and SHG may rise also. Therefore, lower the limit temperatures of the LD and SHG so as not to deteriorate the performances of the LH.
   (When the temperatures of the LD and SHG reach their limits, Err20 occurs.)

* INTLK4.7 occurs easily when the laser beam is emitted after the key switch of the GYC-1000 is turned to the on position for a long time. It is recommended to turn the key switch to the on position just before laser emission.

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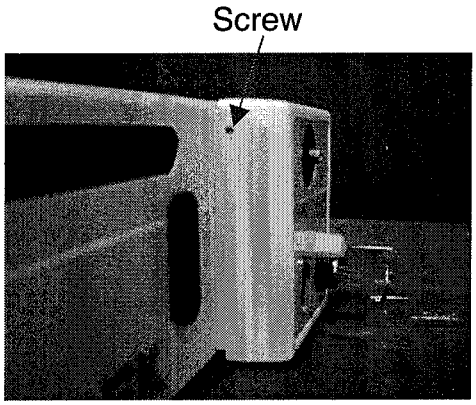
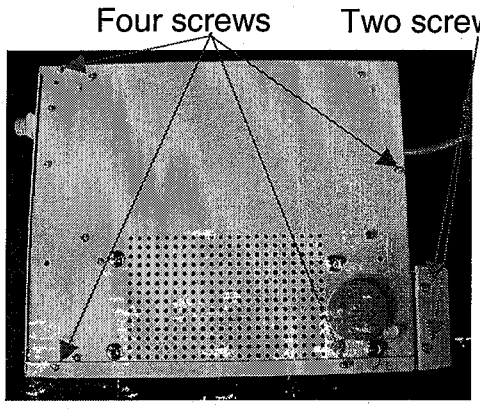
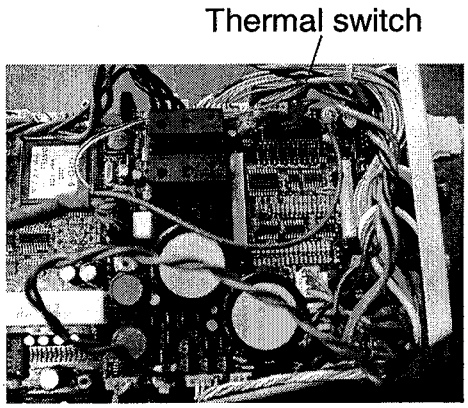
Countermeasure procedures

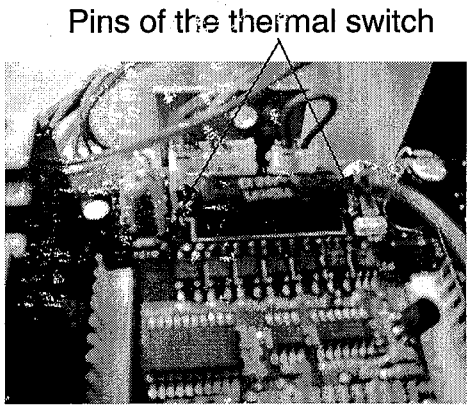
1. Remove the exterior covers of the GYC-1000.
   Remove one screw on the side of the resin cover and six screws on the bottom of the main body (two are for the resin cover).





2. Attach a new thermal switch in parallel with the existing one on BA01.
   Solder the new thermal switch on the pins of the existing one.





3. Attach the exterior covers.
4. Change the parameters.
   Change the parameter values of Addresses 67 and 68 from 15 to 12.

Necessary items

- Thermal switch whose temperature set point is 50°C (Part No.: 17164-E117)
  * Order this by yourself.
- Soldering iron
- Screwdriver

		NUMBER	17164-005E/005J
配 布	SUBJECT （主題）:	S / N	-
N 販	GYC-1000 mounting procedure of the tabletop option	DATE	January 14, 2004
✓ N.Inc		BY	S. Matsuura
✓ 国 際		APPROVED BY	中尾
✓ 品 管	☐ MODIFICATION （変更）	■ INFORMATION （情報）	M. Nakamura
X 製造	☐ PRIORITY （最優先実行）	■ INFORMATION ONLY （情報のみ）	☐ INFORMATION ONLY （マニュアルアップグレード）
✓ サービス	☐ AS NECESSARY （必要時実行）	☐ CHANGE NOTICE （変更通知）	☐ APPLICATION NOTE （アプリケーションノート）
✓ 技 術			
✓ N.SA			
✓ 管 理			

The purpose of this technical bulletin is to inform you of details of the options for the GYC-1000.

[17164-5300] (tabletop option (ZEISS))

The GYC-1000 can be installed on the underside of the tabletop.
Replacing the tabletop of the ZEISS slit lamp that cusomters have allows them to install the GYC-1000.
The width of the tabletop is changed from 600 mm to 760 mm.
(17164-5400 is also changed)

[17164-5400] (tabletop option (NIDEK))

Only the slit lamp to be mounted differs.
17164-5300 is for the ZEISS slit lamp. 17164-5400 is for the NIDEK slit lamp (SL-1600).

The following describes the mounting procedure of the above options.

1. Mounting 17164-5300 (tabletop option (ZEISS))

- Components

Tabletop (W: 760 mm)	1
Bracket for installing the GYC-1000	1 (fixed to the tabletop when shipped)
Accessory box	1 (fixed to the tabletop when shipped)
Power cable	1
Screws (FC4×12)	2

- Required tools
  Phillips screwdriver
  Hexagonal wrench (for M5)

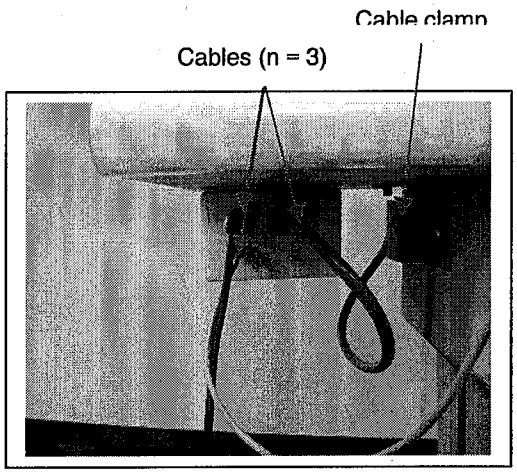
NUMBER	17164-005E/005J

Mounting procedure

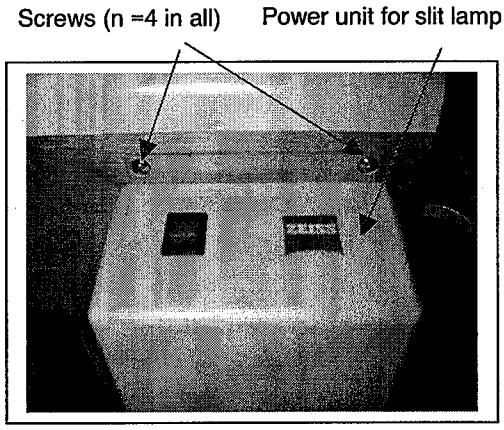
1) Turn OFF the powers of the base and slit lamp.
Disconnect the cable from the rear side of the power unit for the ZEISS slit lamp, which is on the underside of the tabletop.

Replace the power cable with the supplied power cable. (The lengh differs.)

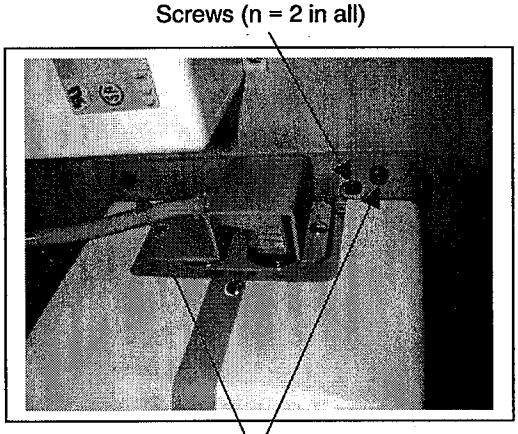
* Here, do not mount the cable clamp.



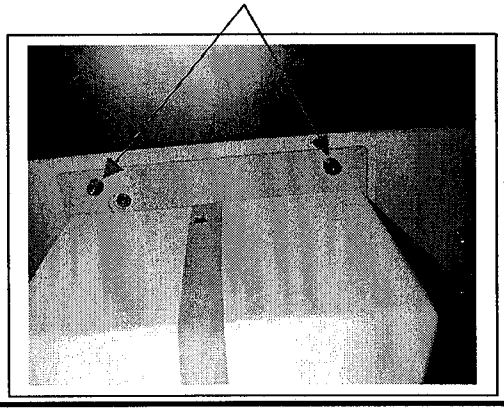
2) Remove the power unit for the ZEISS slit lamp from the tabletop.
Remove the four screws.
* These screws are used later.



3) Remove the slit lamp from the tabletop.
Remove the two screws (M5).
* These screws are used later.

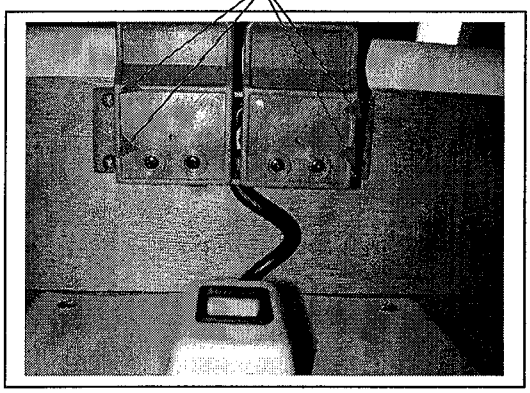


4) Remove the tabletop from the base.
Remove the four screws (M5).
*These screws are used later.

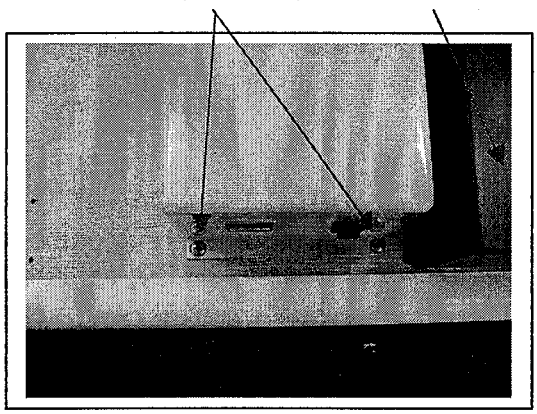


NUMBER	17164-005E/005J

5) Remove the UP/DOWN lever from the underside of the tabletop.
Remove the four screws.
*These screws are used later.

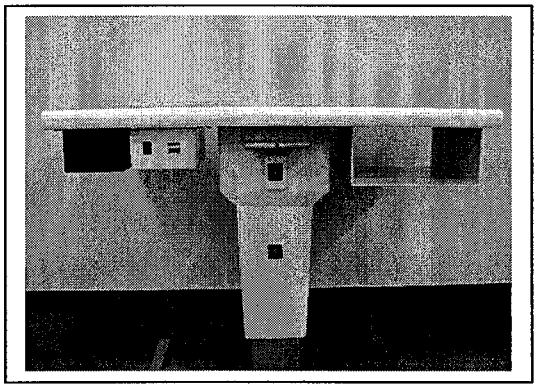


6) Mount the power unit for the ZEISS slit lamp beside the accessory box, which is on the underside of the tabletop.
Use the four screws removed in step 2).



7) Mount the optional tabletop on the base.
Mount the UP/DOWN lever.
Mount them in the reverse order of steps 4) and 5).
Use the screws removed in steps 4) and 5).

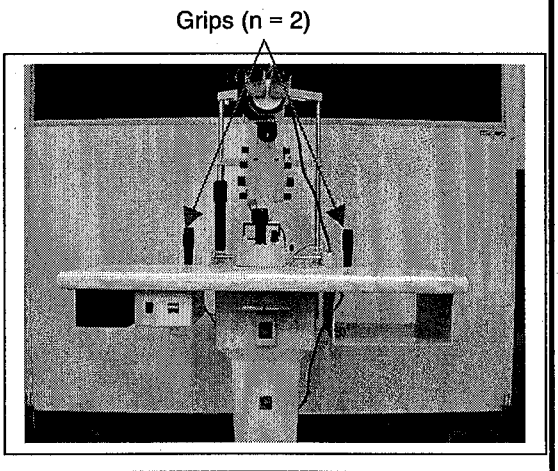
The picture on the right shows that the tabletop is mounted.



8) Mount the ZEISS slit lamp on the tabletop.
Mount it in the reverse order of step 3).
Use the screws removed in step 3).

Connect the cable disconnected in step 1) to the power unit for the slit lamp.
Remount the grips on the optional tabletop.

All components are mounted now.



NUMBER	17164-005E/005J

2. Mounting 17164-5400 (tabletop option (NIDEK))

- Components

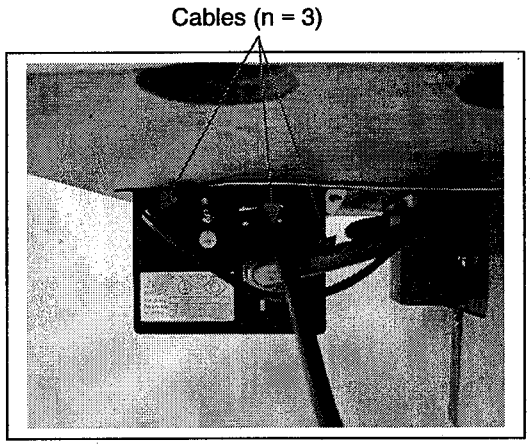
Tabletop (W: 760 mm)	1
Bracket for installing the GYC-1000	1 (fixed to the tabletop when shipped)
Accessory box	1 (fixed to the tabletop when shipped)
Power cable	1
Base plate (for head rest)	2
Screws (SB4)	5

- Required tools
  Phillips screwdriver (including a precision screwdriver)
  Hexagonal wrench (for M4 and M5)

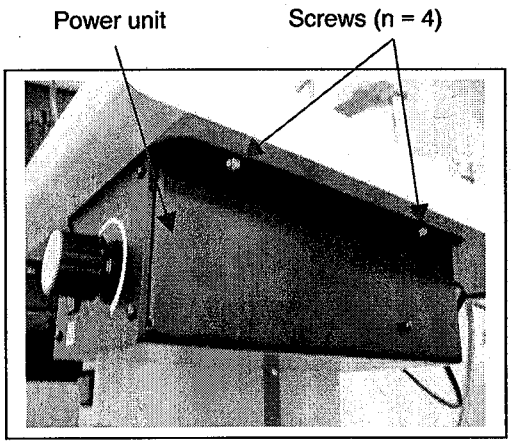
* Since the mounting procedure is about the same as 17164-5300, the pictures of the same steps are omitted.

Mounting procedure

1) Disconnect the cable from the power unit for the NIDEK slit lamp (including a GND wire).
   Replace the power cable with the supplied power cable.



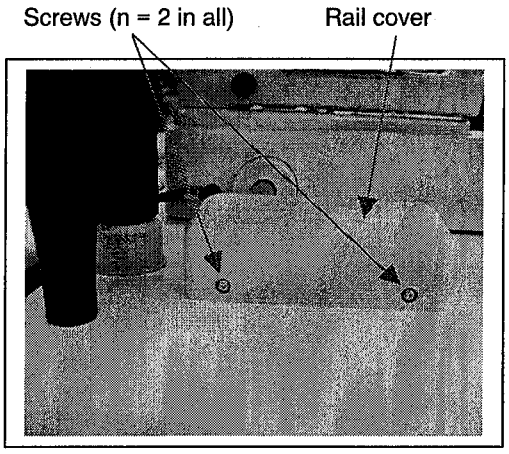
2) Remove the power unit for the NIDEK slit lamp from the tabletop.
   Remove the four screws.



NUMBER	17164-005E/005J

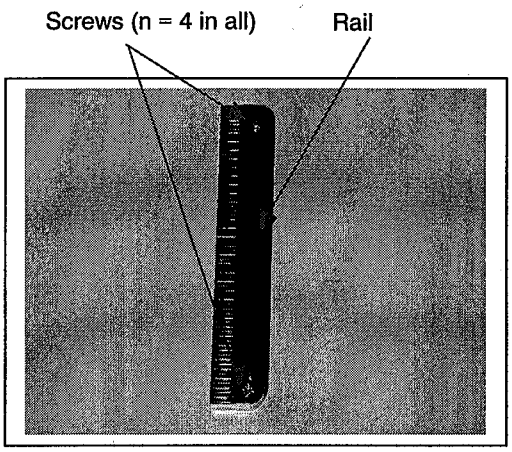
3) Remove the slit lamp.
Remove the two screws from the rail cover (n = 2 for both sides).

Take the slit lamp off the tabletop.



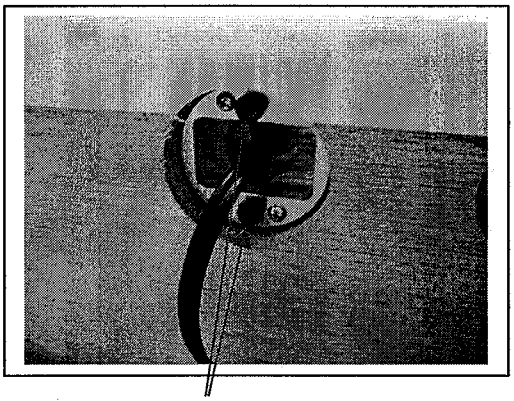
4) Remove the rails on both sides from the tabletop.

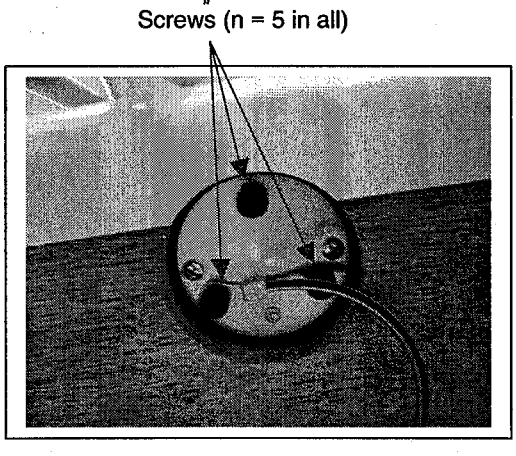
Remount them on the optional tabletop later.



5) Remove the head rest from the tabletop.
Remove the five screws (SB4) from the underside of the tabletop.
Remove the GND wire and use it later.

Also, remove the grips (n = 2) from the tabletop.

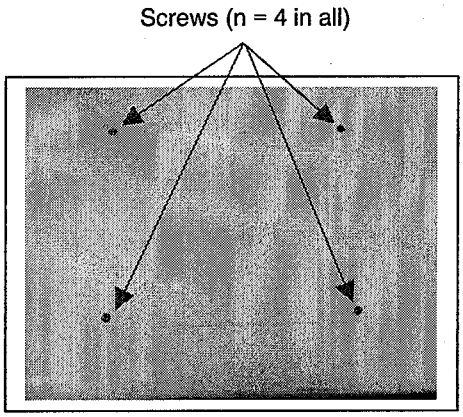




NUMBER	17164-005E/005J

6) Remove the slide plate from the tabletop. Remove the four screws (n = 4). (using a precision screwdriver)

The slide plate is mounted on the optional tabletop later.



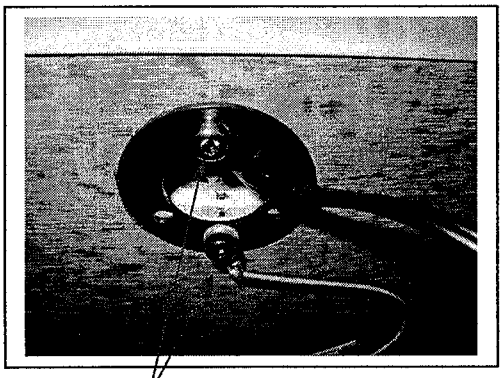
7) Remove the tabletop from the base.
Follow the procedure in steps 4) and 5) of 17164-5300.

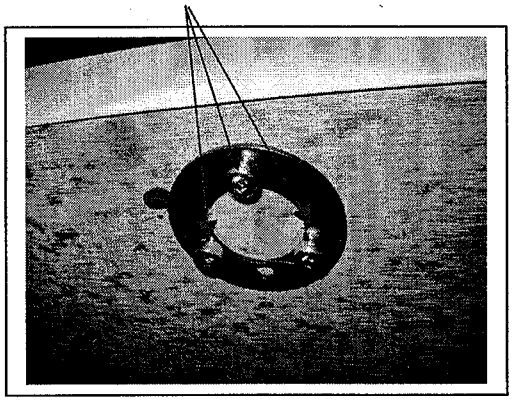
8) Mount the power unit on the optional tabletop.
Follow the procedure in step 6) of 17164-5300.

9) Mount the tabletop on the base.
Mount it in the reverse order of step 7).

10) Mount the head rest on the tabletop.
Put the supplied base plate between the tabletop and the screws, and fix the five screws.

Also fix the GND wire, and connect it to the power unit.





11) Mount the slit lamp on the tabletop.
Mount it in the reverse order of steps 3), 4) and 6).

GYC-1000 TECHNICAL BULLETIN

（技 術 公 報）

		NUMBER	17164-004E/004J
配 布	SUBJECT （主題）:	S / N	–
N 販	GYC-1000 Options	DATE	November 21, 2003
✓ N.Inc		BY	S. Matsuura
✓ 国 際		APPROVED BY	H. Nakamura
✓ 品 管	☐ MODIFICATION （変更） ■ INFORMATION （情報）		中尾
X 製造	☐ PRIORITY （最優先実行） ■ INFORMATION ONLY （情報のみ） ☐ MANUAL UPGRADE （マニュアルアップグレード）		
✓ サービス			
✓ 技 術	☐ AS NECESSARY （必要時実行） ☐ CHANGE NOTICE （変更通知） ☐ APPLICATION NOTE （アプリケーションノート）		
✓ N.SA			
✓ 管 理			

The purpose of this Technical Bulletin is to inform you of the options on the GYC-1000.

○17164-5100 (handle for main body)

This handle, which facilitates carrying the main body, is mounted on the main body of the GYC-1000.

When opening the cover with the handle mounted, remove the handle beforehand.

○17164-5200 (CV mounting unit)

This unit allows the main body of the GYC-1000 to be installed on the NIDEK CV-24000 (cataract and vitreous surgical system). It can be installed on the shipped products (CV-24000).

Mounting this unit blocks the photodetector beside the speaker. Use the photodetector above the LCD touch panel.

As the tray on the main body may contact this unit, move the tray to the lowest position. Also, do not put any objects on the tray when it is stored.

The following describes the mounting procedures.

NUMBER	17164-004E/004J

1. 17164-5100 (handle for main body) mounting procedure

♦ Accessories

Handle	1
Rubber feet	4
Screws (FC4x12)	2

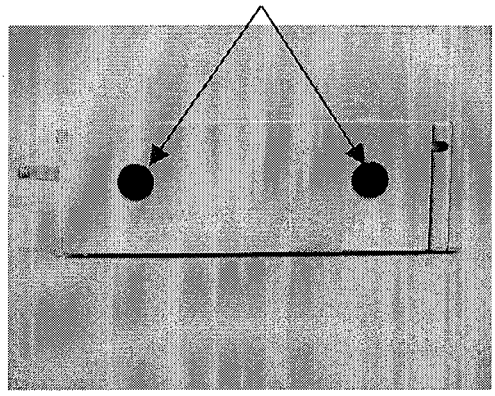
Requirements

• Phillips screwdriver (including precision screwdriver)

♦ Mounting procedure

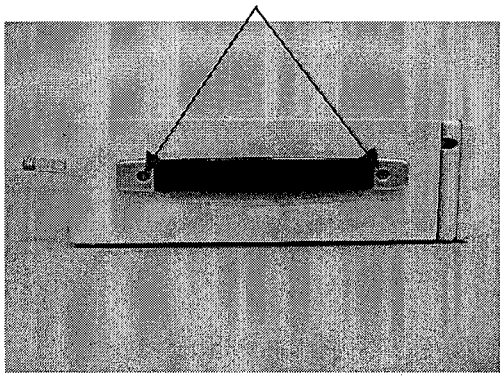
1) Remove the parts (n = 2) from the main body of the GYC-1000.
   Remove the four screws.

Parts (n = 2)



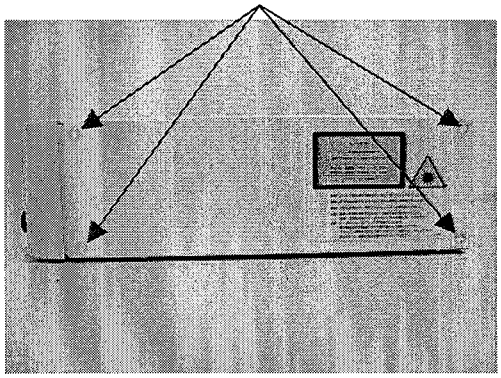
2) Mount the handle with the two screws (FC4).

Screws (n = 2)



3) Attach the rubber feet (n=4) so that they are placed proportionally.

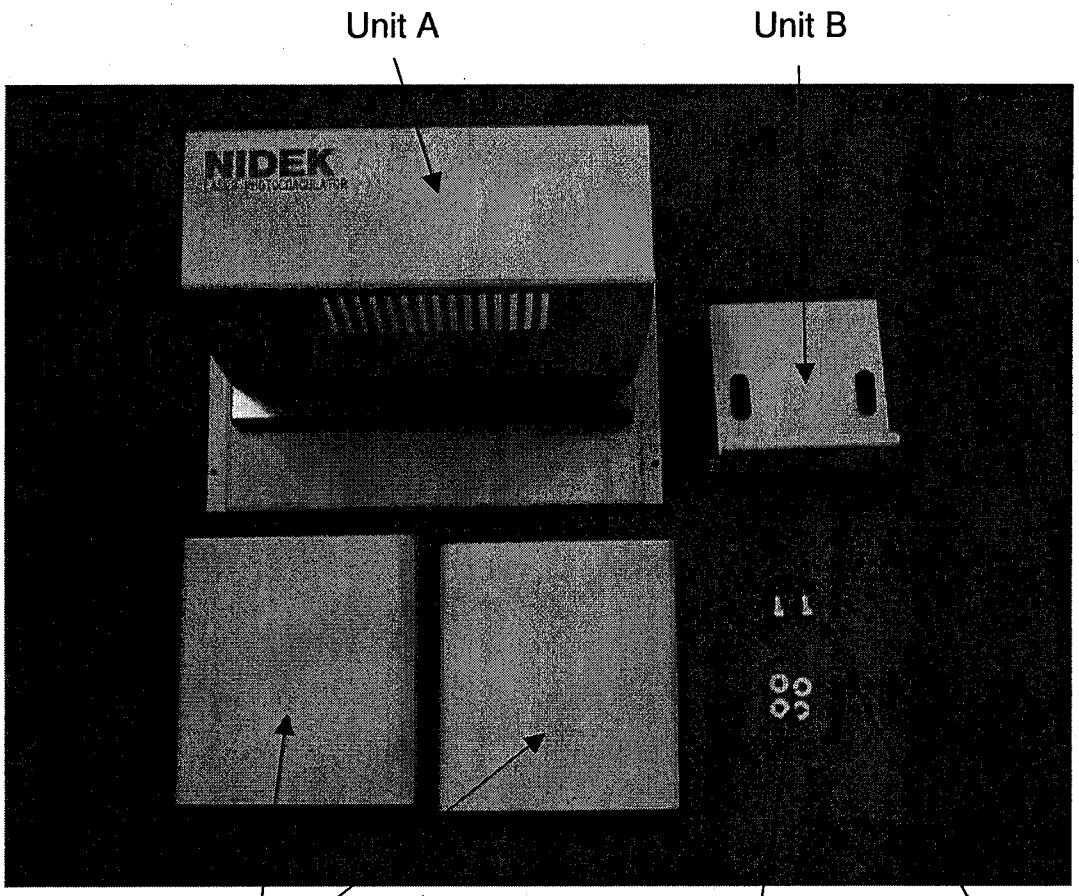
Rubber feet (n = 4)



NUMBER	17164-004E/004J

2. 17164-5200 (CV mounting unit) mounting procedure

♦ Accessories



Others (screws)

• Fixing the unit A	SB4×12	4
	SW4	4
	3PW4	4
Fixing screws	TC5×10	2
Fixing the main body (GYC-1000)	FC4×12	3

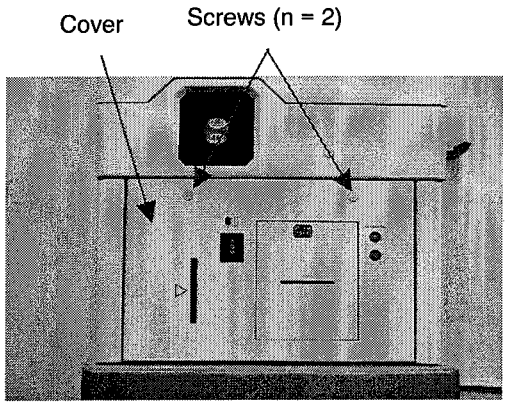
Requirements

- Phillips screwdriver (80 mm or less in length required)
- Hexagonal wrench (for M4)

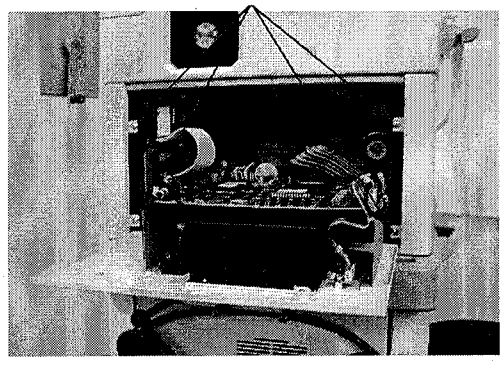
NUMBER	17164-004E/004J

♦ Mounting procedures

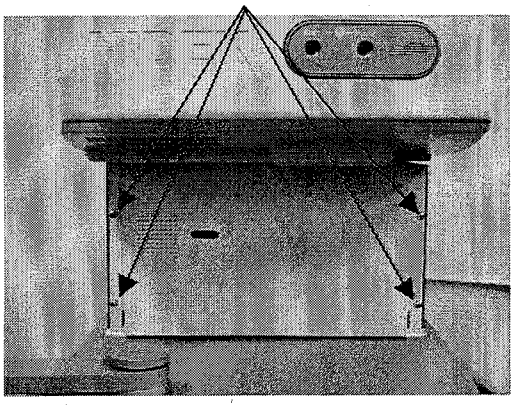
1) Remove the caps from the rear of the CV-24000. Loosen the screws (n = 2) and open the cover.



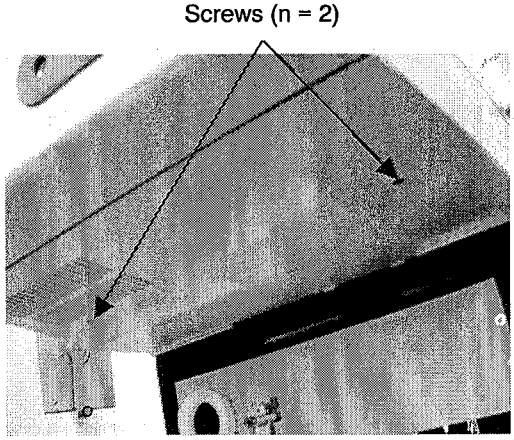
2) Remove the right cover and left cover from the main body.
Screws: n = 2 for each side



3) Remove the front cover of the main body.
Screws: n = 4

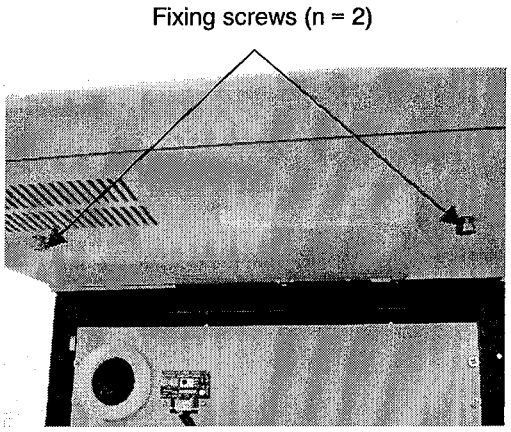


4) Remove the two screws (SB4) that fix the underside cover of the main body.



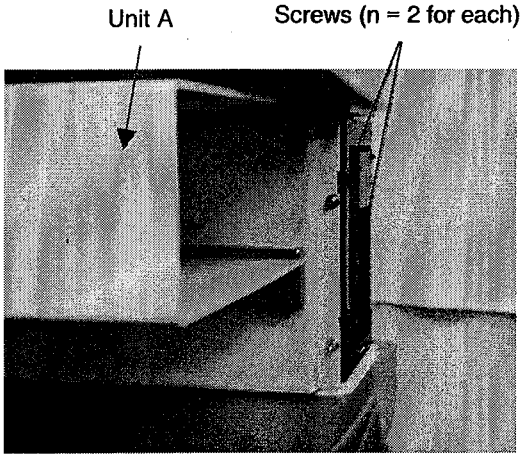
NUMBER	17164-004E/004J

5) Tighten the fixing screws (n = 2) on the holes from where screws were removed in step 4).

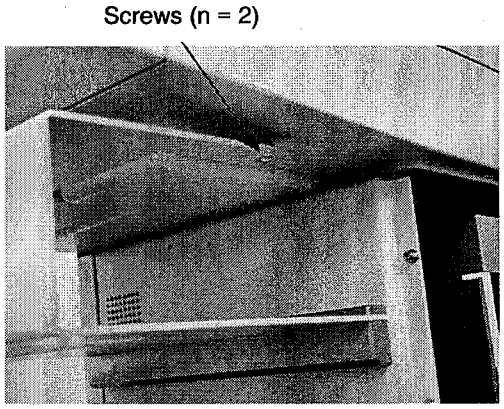


6) Mount the unit A on the main body.
Tighten the following screws on the screw holes from where screws were removed in step 3).
Two screws for each side (n = 4 in all)
Screw type SB4×12, SW4, 3PW4 (4 for each)

* When mounting the unit A, be sure to move the tray to the lowest position.

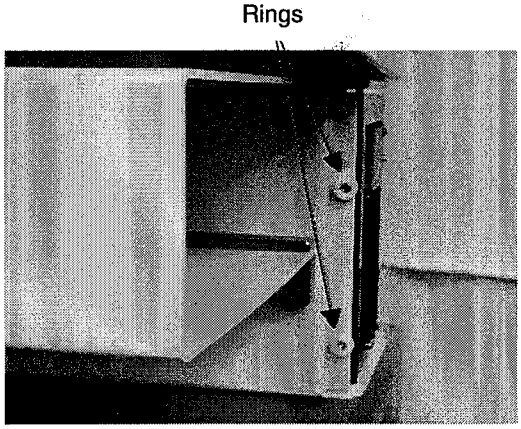


7) Fix the unit A on the fixing screws (n = 2) tightened in step 5) with the following screws.
Screw type TC5×10



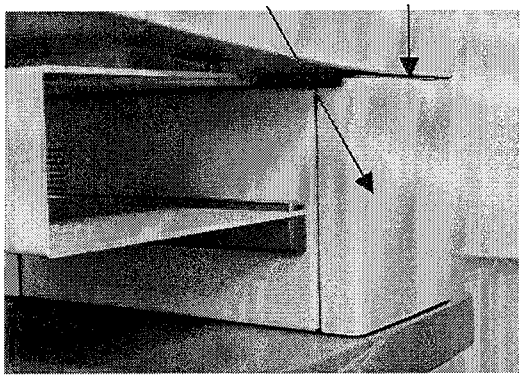
8) Attach the rings to the heads of the screws tightened in step 6).
Rings: n = 4 in all

* The rings fill in the clearance so that the right cover or left cover can be fixed.

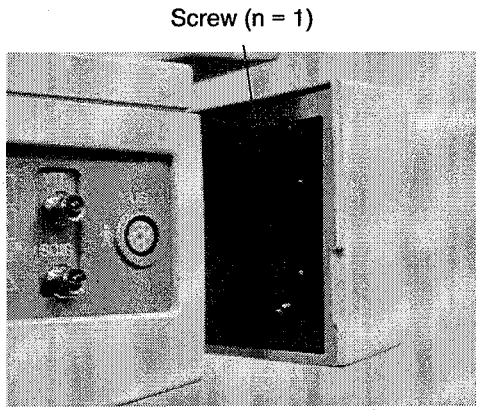


NUMBER	17164-004E/004J

9) Attach the right cover and left cover.
Fix the cover using the screw holes from where screws were removed in step 2).
Remove the prooftape from the original covers and then reattach them to the covers to be replaced.
Close the cover at the rear. Now the unit for the GYC-1000 has been completed.



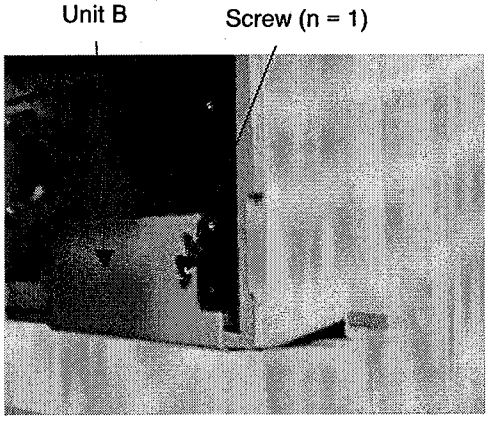
10) The following describes the mounting procedure of the unit B that fixes the control box of the GYC-1000.
Open the main body as shown in the picture on the right.
Remove the screw (n=1).
* To remove this screw, a short Phillips screwdriver (approx. 80 mm or less in length) is required.
A ratchet screwdriver is also available.

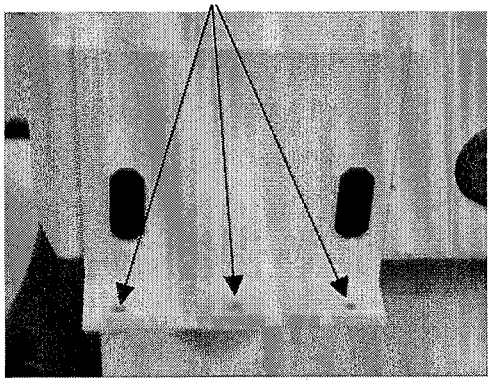


11) Mount the unit B as shown in the picture on the right.
Use the screw removed in step 10).
- Before fixing the unit B on the main body, loosen the three screws slightly.

See the picture on the lower right.

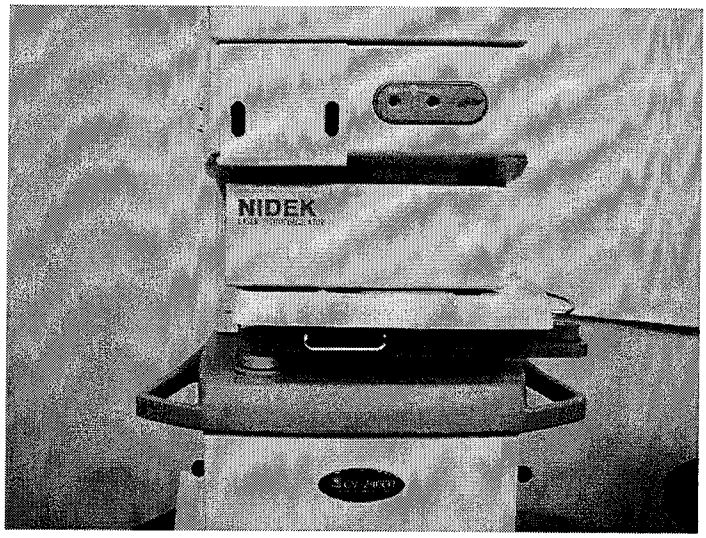
After mounting the unit on the main body, retighten the screws.



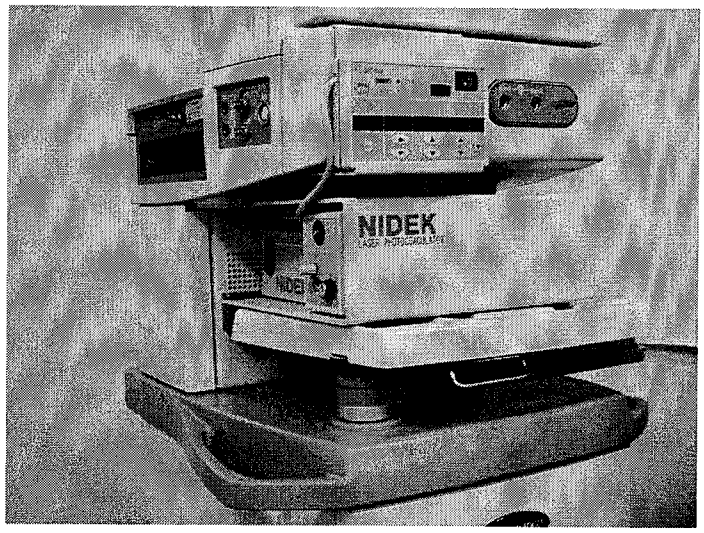


NUMBER	17164-004E/004J

The picture on the right shows the CV-24000 with the unit mounted.

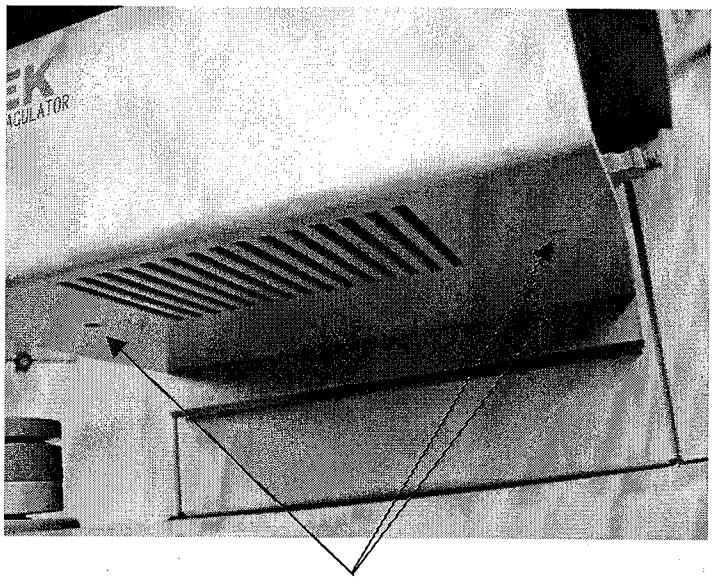


The picture on the right shows the CV-24000 with the GYC-1000 installed.



To fix the GYC-1000, the three screws as shown in the picture on the right can be used for fixing.
Screw type FC4

* To fix the main body, do not screw too tightly.
Otherwise, the rubber feet on the main body of the GYC-1000 may be damaged.



Holes for fixing the main body

GYC-1000 TECHNICAL BULLETIN

(技 術 公 報)

NUMBER	17164-002E/002J
S/N	From 10001
DATE	November 17, 2003
BY	H. Abe
APPROVED BY	H. Nakamura 中尾

配布	
	N 販
√	N.Inc
√	国際
	品保
√	品管
	組 1
√	サービス
√	X1 開
	技管
√	N.SA
	生技

SUBJECT(主題):

Adjustment of the power output and the power output deviation limits (for overpower and underpower)

☐ MODIFICATION (変更) ■ INFORMATION (情報)

☐ PRIORITY (最優先実行) ■ INFORMATION ONLY (情報のみ) ☐ MANUAL UPDATE (マニュアル アップデート)

☐ AS NECESSARY (必要時実行) ☐ CHANGE NOTICE (変更通知) ☐ APPLICATION NOTE (アプリケーション ノート)

This technical bulletin (TB) describes the method of adjustment of the power output and the power output deviation limits of the GYC-1000.

1. Checking the output
   (1) Connect the delivery unit to the main body. Then measure the actual output power of the green laser beam at the aperture of the delivery unit with the settings 100 mW and 1000 mW. (In the case of the slit lamp delivery, set the spot size to 200 μm.)
   (2) If the setting and the actual power output are different, steps 2 and 3 described below must be executed. (As a guideline, if the difference is ± 10 % or more, execute the power output adjustment.)

2. Power output adjustment
   (1) Execute the fiber-optic cable alignment.
   (2) Set the power output to 1000 mW and the exposure time to 3.00sec.
   (3) Emit the green laser beam and measure the actual power output at the aperture of the delivery unit.
   (4) Remove the round cap on the rear of the control box with a precision screwdriver.
   (5) Set "6" of the DIP switch on the circuit board to the OFF (opposite) side with a precision screwdriver.
   (6) Input the parameters of the following addresses again:

Parameter addresses	Corresponding delivery unit
20	SL-130
21	SL-1600
24	Endo
26	BIO
27	Haag
28	Combo

   * Example: If the actual power output is 10 % lower than the setting, increase the parameter by 10 %.
   (7) Set "6" of the DIP switch to the ON side.
   (8) Emit the green laser beam and measure the actual power output at the aperture of the delivery unit.
   (9) If the actual power output differs from the setting by ± 10 % or more, return to step (5).
   (10) Set the power output to 50 mW.
   (11) Emit the green laser beam and measure the actual power output at the aperture of the delivery unit.
   (12) Set "6" of the DIP switch on the circuit board to the OFF (opposite) side with a precision screwdriver.
   (13) Input the parameter of the following address again:
   18
   *Example: If the actual power output is lower than the setting, increase the parameter.
   (14) Set "6" of the DIP switch to the ON side.
   (15) Emit the green laser beam and measure the actual power output at the aperture of the delivery unit.
   (16) If the actual power output differs from the setting by ± 10 % or more, return to step (10).
   (17) Check if the actual power output is within ±10% with the setting 1000 mW and 50 mW. If it is not, return to step (5).

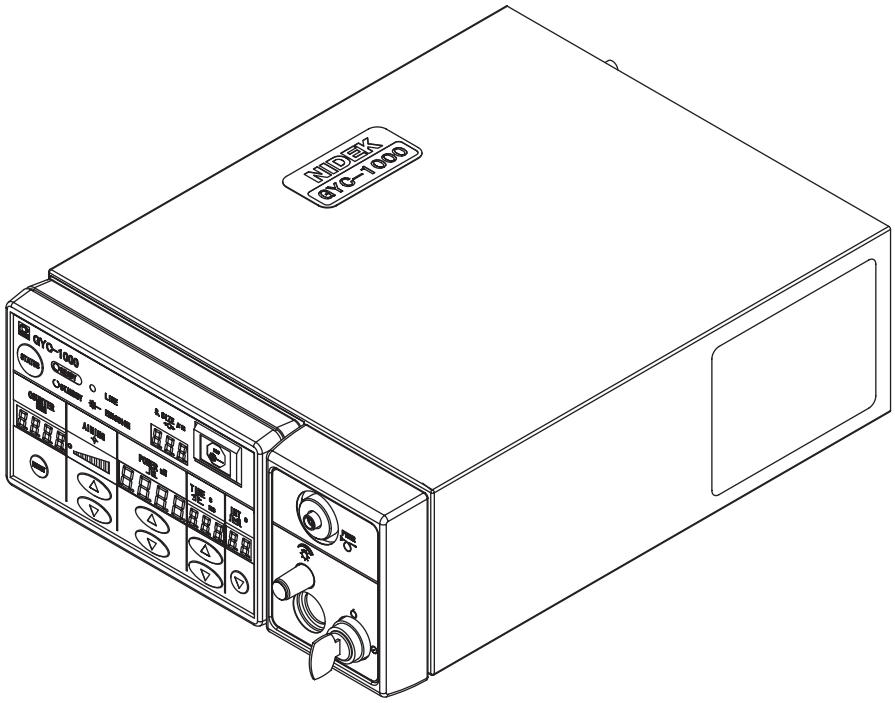
3. Adjustment of the power output deviation limits (overpower and underpower)
   (1) Remove the cover of the main body.
   (2) Connect the delivery unit. Set the power output to 1000 mW, and the exposure time to 3.00 sec.
   (3) Set "1" and "2" of the DIP switch to the OFF side.
   *** Gain adjustment of overpower and underpower ***
   (4) Connect CH1 of the oscilloscope to TP9, and CH2 to TP8 on the master board.
   (0.5V/Div, 500msec/Div)
   (5) Emit the green laser beam and adjust VR6 on the master board so that the voltage of to TP8 becomes +20% of TP9. (Gain adjustment of overpower).
   (6) If the intermittent beep sounds are heard in the condition described in (5) above, set "6" of the DIP switch to the OFF side and increase the parameter of address 55. After that, reset "6" of the DIP switch to the ON side. (If the intermittent beep sounds are not heard, decrease the parameter.)
   (7) Emit the green laser beam and change the parameter to the point where the intermittent beep sounds are heard at random intervals.
   (8) Emit the green laser beam and adjust VR6 on the master board so that the voltage of TP8 becomes – 20 % of that of TP9. (Gain adjustment of underpower)
   (9) If the intermittent beep sounds are heard in the condition described in (5) above, set "6" of the DIP switch to the OFF side and increase the parameter of address 58. After that, reset "6" of the DIP switch to the ON side. (If the intermittent beep sounds are not heard, decrease the parameter.)
   (10) Emit the green laser beam and change the parameter to the point where the intermittent beep sounds are heard at random intervals.
   (11) Emit the green laser beam and adjust VR6 on the master board so that the voltage of TP8 becomes the same as that of TP9. (Returned to the original state)
   *** Offset adjustment of overpower and underpower ***
   (12) Connect the delivery unit. Set the power output to 50 mW, and the exposure time to 3.00sec.
   (13) Connect CH1 of the oscilloscope to TP5, and CH2 to TP4 on the master board.
   (0.5V/Div、500msec/Div)
   (14) Emit the green laser beam and adjust VR6 on the master board so that the voltage of TP4 becomes + 20 % of that of TP5. (Offset adjustment of overpower)
   (15) If the intermittent beep sounds are heard in the condition described in (5) above, set "6" of the DIP switch to the OFF side and increase the parameter of address 56. After that, reset "6" of the DIP switch to the ON side. (If the intermittent beep sounds are not heard, decrease the parameter.)
   (16) Emit the green laser beam and change the parameter to the point where the intermittent beep sounds are heard at random intervals.
   (17) Emit the green laser beam and adjust VR6 on the master board so that the voltage of TP4 becomes – 20 % of that of TP5. (Offset adjustment of underpower)
   (18) If the intermittent beep sounds are heard in the condition described in (5) above, set "6" of the DIP switch to the OFF side and increase the parameter of address 59. After that, reset "6" of the DIP switch to the ON side. (If the intermittent beep sounds are not heard, decrease the parameter.)
   (19) Emit the green laser beam and change the parameter to the point where the intermittent beep sounds are heard at random intervals.
   *** After the adjustment, reset the voltage of TP to the original state ***
   (20) Connect CH1 of the oscilloscope to TP9, and CH2 to TP8 on the master board.
   (0.5V/Div、500msec/Div)
   (21) Emit the green laser beam and adjust VR6 on the master board so that the voltage of TP8 becomes the same as that of TP9. (Returned to the original state)
   (22) Attach the cover on the main body. Reset "1" and "2" of the DIP switch to the original state. Then perform the function check.

NIDEK

GREEN LASER PHOTOCOAGULATOR

Model GYC-1000

SERVICE MANUAL



NIDEK CO., LTD.

January 22, 2004
Pages in total: 68
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§1 INTRODUCTION

This service manual contains service instructions for the NIDEK GREEN LASER PHOTOCOAGULATOR, GYC-1000.

For correct service, thorough understanding of the contents of this manual is required prior to the service.

Use this manual together with the GYC-1000 Operator's Manual and Parts List.

The specifications and design of this instrument are subject to change without notice for improvement. In the case of major changes, refer to the corresponding TECHNICAL BULLETIN issued in each occasion.

If the instrument cannot be repaired by repair operations in accordance with this Service Manual, please inform NIDEK of the Serial Number of the instrument, and details of the symptom.

§2 SAFETY

2.1 General precautions

- Only NIDEK service persons and persons trained by NIDEK for the GYC-1000 service work are allowed to repair the instrument.
- Observe the procedures to perform the repair work. If not, accidents or failure of the instrument may result.
- When performing the maintenance work, turn OFF the power switch, and disconnect the power cord from the wall outlet unless the power needs to be ON.

2.2 Cautions in maintenance

- Take action against static electricity before service work.
- In case of instrument malfunction, turn OFF the power switch after checking the symptom.
- Never drop parts or screws inside the instrument, nor bump it against surrounding objects.
- Prepare storage cases so as not to lose the removed screws or parts.
- Screw or unscrew the screws with proper tools.
- After loosening the screws fixed by a thread-locking adhesive, be sure to reapply the thread-locking adhesive to the screws when you retighten them.
- After replacing parts, make sure that they are fixed securely before turning ON the power.
- If you observe strange odors or smoke being issued from the instrument, immediately turn OFF the instrument, disconnect the power cord from the outlet, and diagnose the cause. If the instrument is powered in abnormal conditions, fire, electric shock or total loss of the instrument may result.
- Refer to "8.1 Wiring diagram" and "8.2 Connectors and cables," for checking cable breaks as described in "§4 SUB-TROUBLESHOOTING". In addition, check cables for the following:

  ① Connectors are connected and crimped securely.

  ② No contact failure occurs after re-connection of connectors.

  ③ Cables are soldered properly.
- Do not pull the cables strongly. Cable breaks etc. may result.

- Never perform continuous emission for more than 10 seconds because this puts an enormous load on the power supply.

- Never emit the laser beam onto reflective objects such as a metal surface.

- Wear the safety goggles for the GYC-1000.

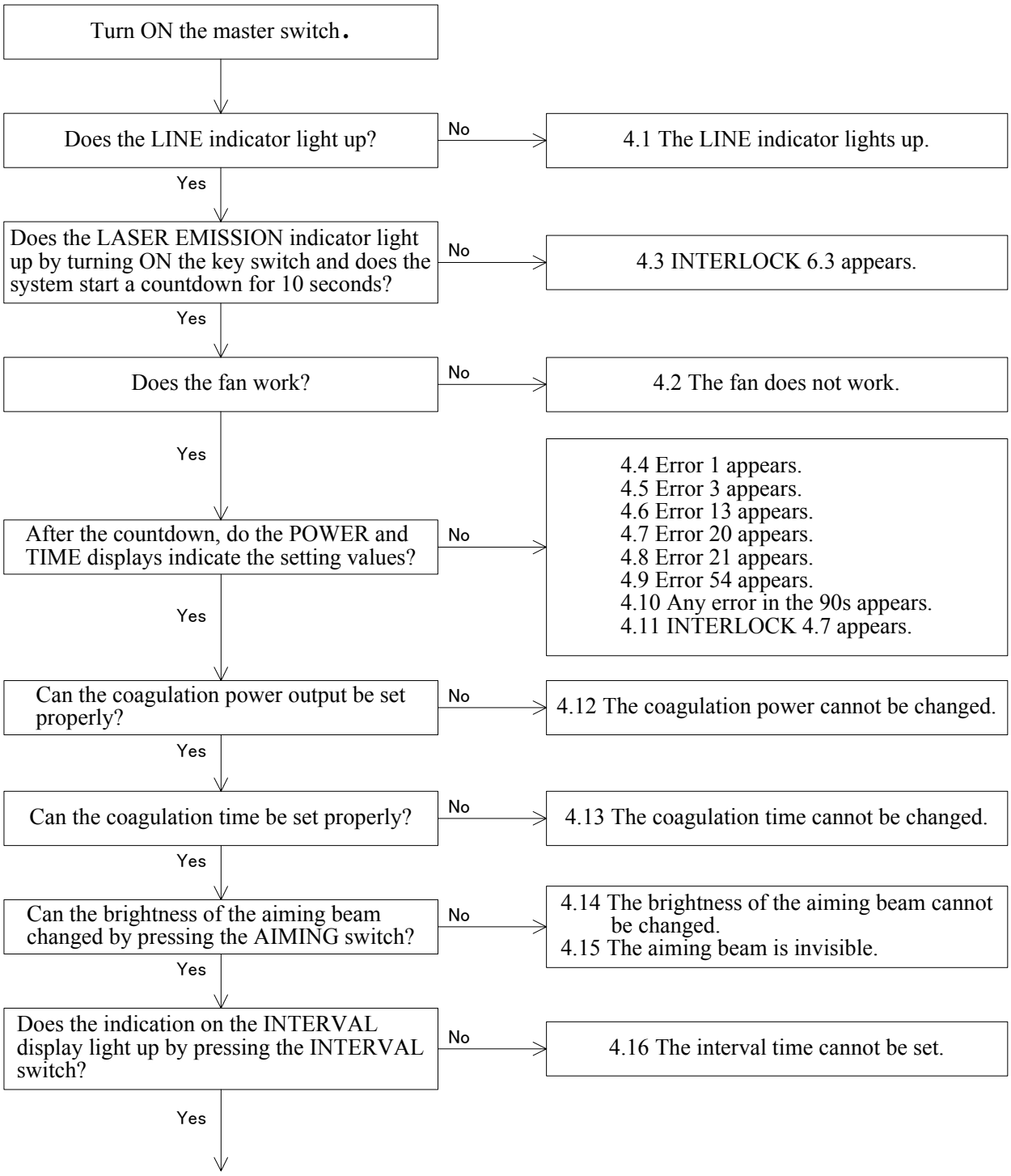
- Never emit the laser beam (direct light) to a human body or any object.

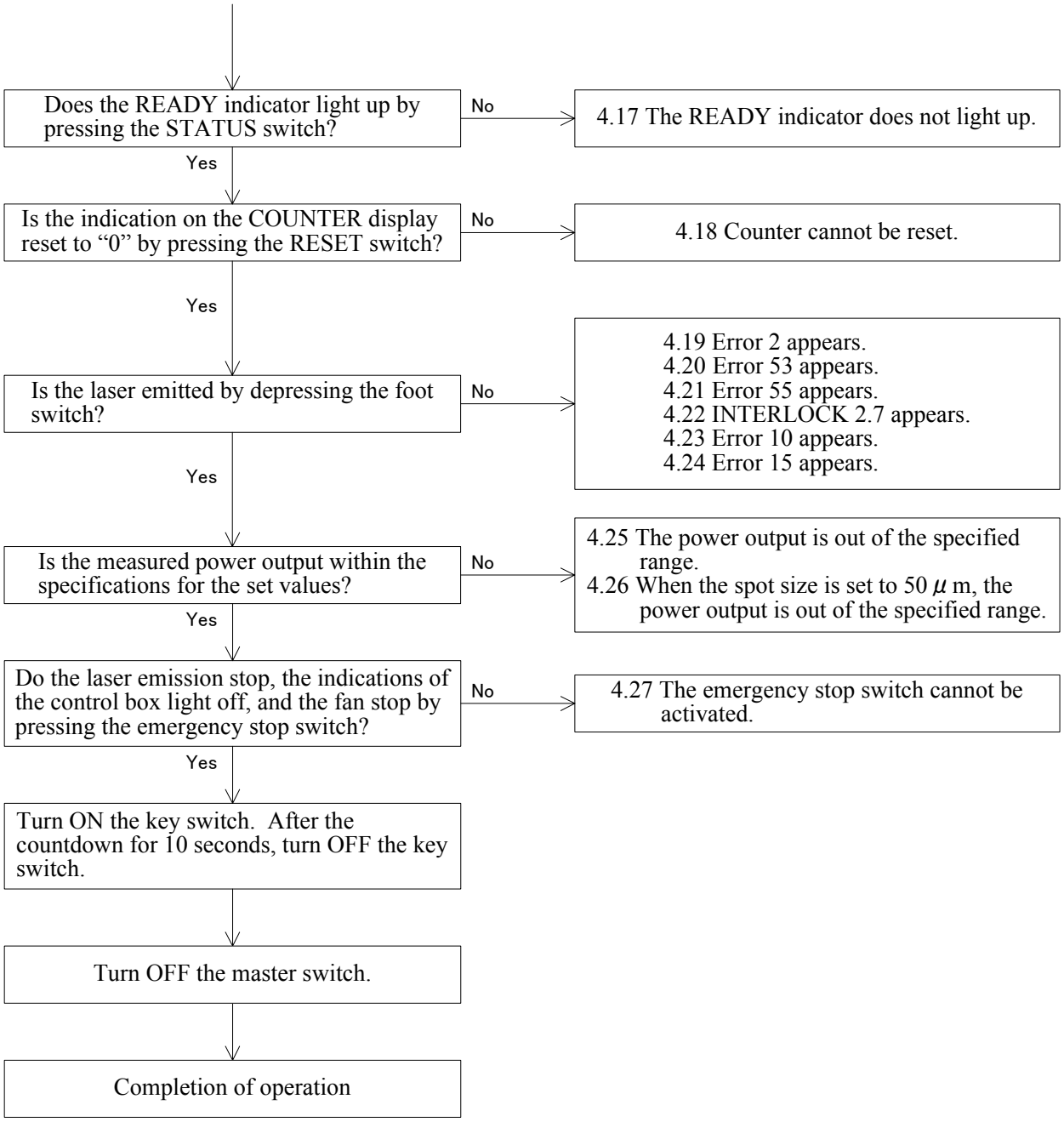
2.3 Cautions in adjustment

- Perform adjustment on a vibration-free, stable and level surface.
  A slanted floor or place subject to vibration will obstruct accurate adjustment.

- Do not use a calibration jig for usage other than described in this manual.

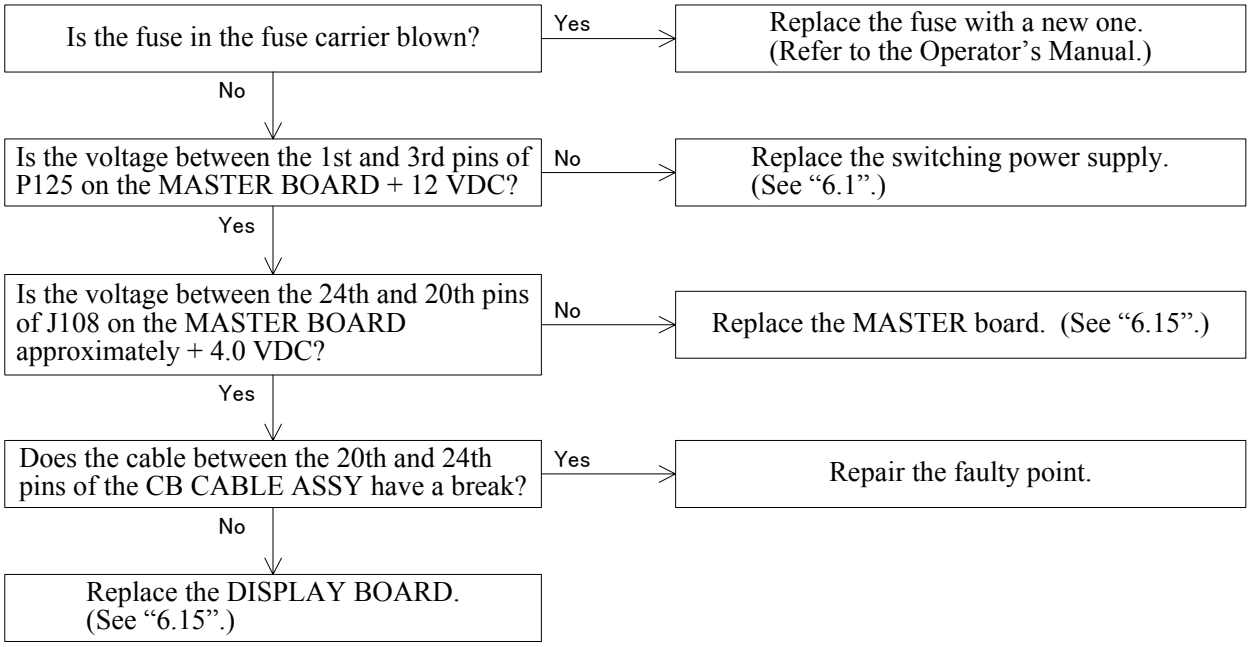
§3 TROUBLESHOOTING


Turn ON the master switch.
Does the LINE indicator light up?
No
4.1 The LINE indicator lights up.
Yes
Does the LASER EMISSION indicator light up by turning ON the key switch and does the system start a countdown for 10 seconds?
No
4.3 INTERLOCK 6.3 appears.
Yes
Does the fan work?
No
4.2 The fan does not work.
Yes
After the countdown, do the POWER and TIME displays indicate the setting values?
No
4.4 Error 1 appears.
4.5 Error 3 appears.
4.6 Error 13 appears.
4.7 Error 20 appears.
4.8 Error 21 appears.
4.9 Error 54 appears.
4.10 Any error in the 90s appears.
4.11 INTERLOCK 4.7 appears.
Yes
Can the coagulation power output be set properly?
No
4.12 The coagulation power cannot be changed.
Yes
Can the coagulation time be set properly?
No
4.13 The coagulation time cannot be changed.
Yes
Can the brightness of the aiming beam changed by pressing the AIMING switch?
No
4.14 The brightness of the aiming beam cannot be changed.
4.15 The aiming beam is invisible.
Yes
Does the indication on the INTERVAL display light up by pressing the INTERVAL switch?
No
4.16 The interval time cannot be set.
Yes


Does the READY indicator light up by pressing the STATUS switch?
No
4.17 The READY indicator does not light up.
Yes
Is the indication on the COUNTER display reset to "0" by pressing the RESET switch?
No
4.18 Counter cannot be reset.
Yes
Is the laser emitted by depressing the foot switch?
No
4.19 Error 2 appears.
4.20 Error 53 appears.
4.21 Error 55 appears.
4.22 INTERLOCK 2.7 appears.
4.23 Error 10 appears.
4.24 Error 15 appears.
Yes
Is the measured power output within the specifications for the set values?
No
4.25 The power output is out of the specified range.
4.26 When the spot size is set to 50 μm, the power output is out of the specified range.
Yes
Do the laser emission stop, the indications of the control box light off, and the fan stop by pressing the emergency stop switch?
No
4.27 The emergency stop switch cannot be activated.
Yes
Turn ON the key switch. After the countdown for 10 seconds, turn OFF the key switch.
Turn OFF the master switch.
Completion of operation

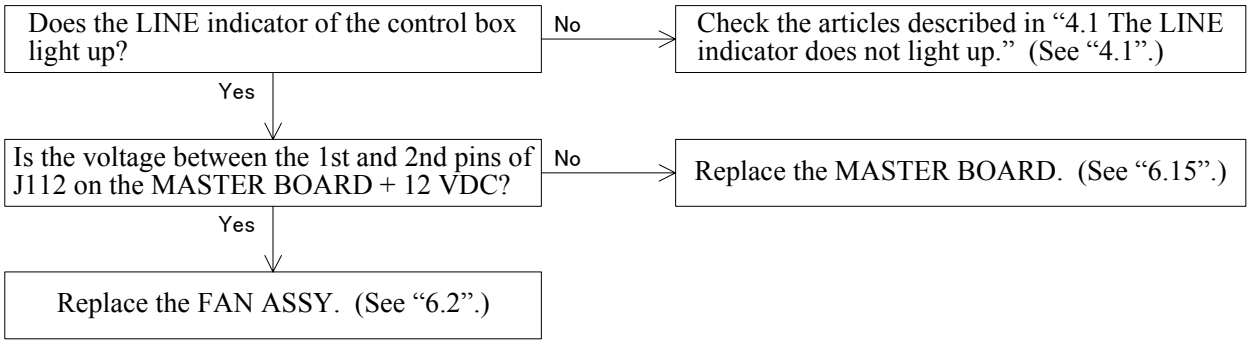
§4 SUB-TROUBLESHOOTING

4.1 The LINE indicator does not light up.

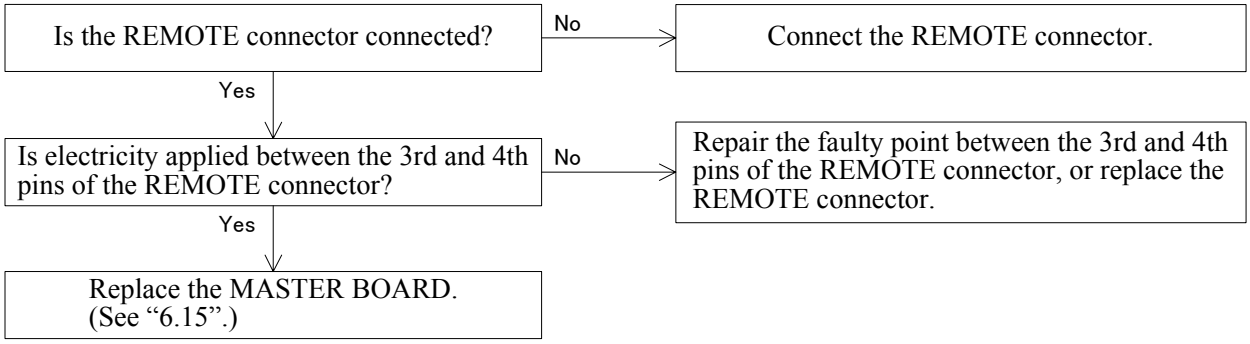

Is the fuse in the fuse carrier blown?
Yes
Replace the fuse with a new one. (Refer to the Operator's Manual.)
No
Is the voltage between the 1st and 3rd pins of P125 on the MASTER BOARD + 12 VDC?
No
Replace the switching power supply. (See "6.1".)
Yes
Is the voltage between the 24th and 20th pins of J108 on the MASTER BOARD approximately + 4.0 VDC?
No
Replace the MASTER board. (See "6.15".)
Yes
Does the cable between the 20th and 24th pins of the CB CABLE ASSY have a break?
Yes
Repair the faulty point.
No
Replace the DISPLAY BOARD. (See "6.15".)

4.2 The fan does not work.

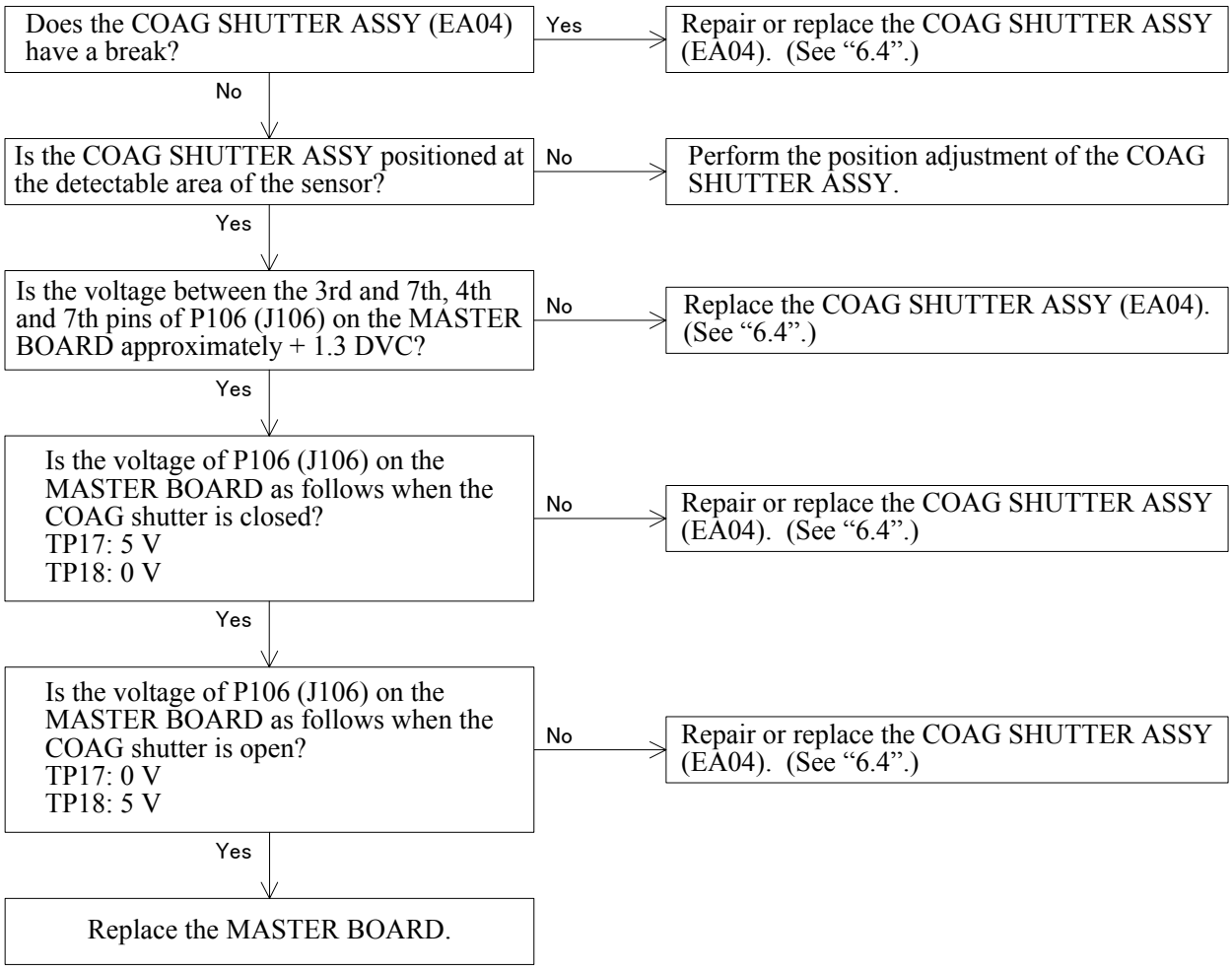
* The fan does not work when the temperature is lower than the specified one (25 degrees C).


Does the LINE indicator of the control box light up?
No
Check the articles described in "4.1 The LINE indicator does not light up." (See "4.1".)
Yes
Is the voltage between the 1st and 2nd pins of J112 on the MASTER BOARD + 12 VDC?
No
Replace the MASTER BOARD. (See "6.15".)
Yes
Replace the FAN ASSY. (See "6.2".)

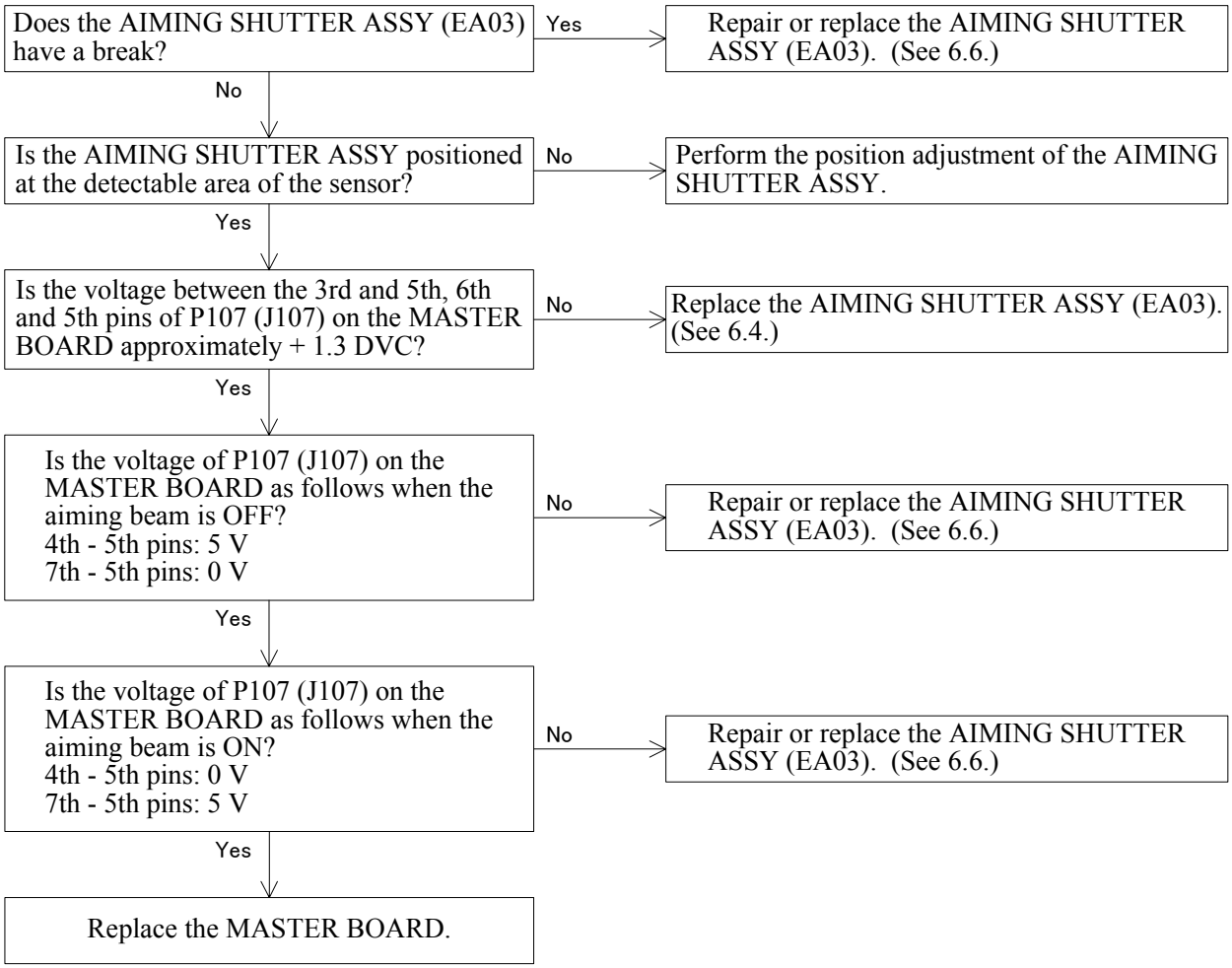
4.3 INTERLOCK 6.3 appears.


Is the REMOTE connector connected?
No
Connect the REMOTE connector.
Yes
Is electricity applied between the 3rd and 4th pins of the REMOTE connector?
No
Repair the faulty point between the 3rd and 4th pins of the REMOTE connector, or replace the REMOTE connector.
Yes
Replace the MASTER BOARD. (See “6.15”.)

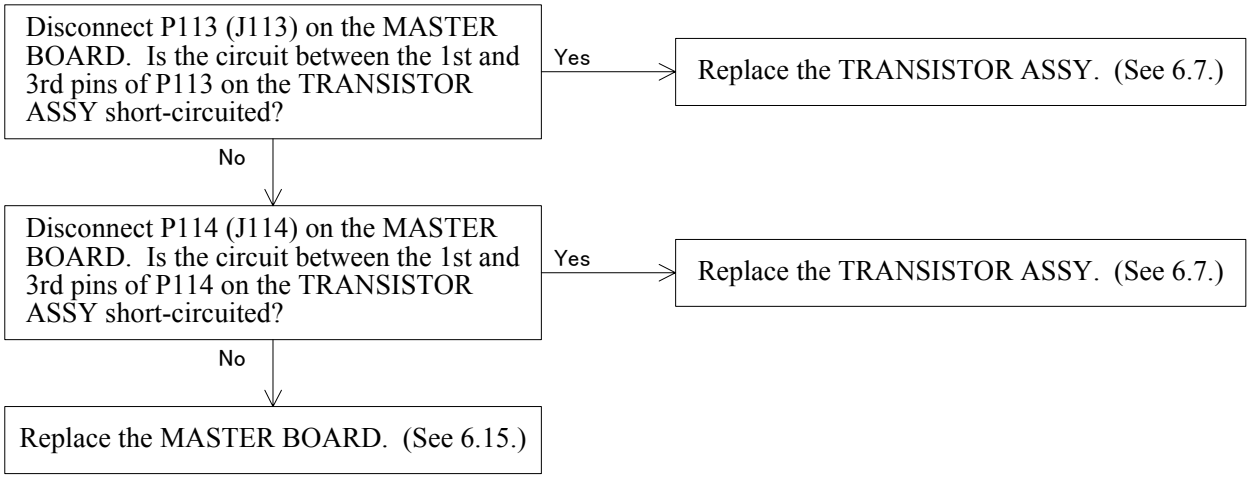
4.4 Error 1 appears.


Does the COAG SHUTTER ASSY (EA04) have a break?
Yes
Repair or replace the COAG SHUTTER ASSY (EA04). (See “6.4”.)
No
Is the COAG SHUTTER ASSY positioned at the detectable area of the sensor?
No
Perform the position adjustment of the COAG SHUTTER ASSY.
Yes
Is the voltage between the 3rd and 7th, 4th and 7th pins of P106 (J106) on the MASTER BOARD approximately + 1.3 DVC?
No
Replace the COAG SHUTTER ASSY (EA04). (See “6.4”.)
Yes
Is the voltage of P106 (J106) on the MASTER BOARD as follows when the COAG shutter is closed?
TP17: 5 V
TP18: 0 V
No
Repair or replace the COAG SHUTTER ASSY (EA04). (See “6.4”.)
Yes
Is the voltage of P106 (J106) on the MASTER BOARD as follows when the COAG shutter is open?
TP17: 0 V
TP18: 5 V
No
Repair or replace the COAG SHUTTER ASSY (EA04). (See “6.4”.)
Yes
Replace the MASTER BOARD.

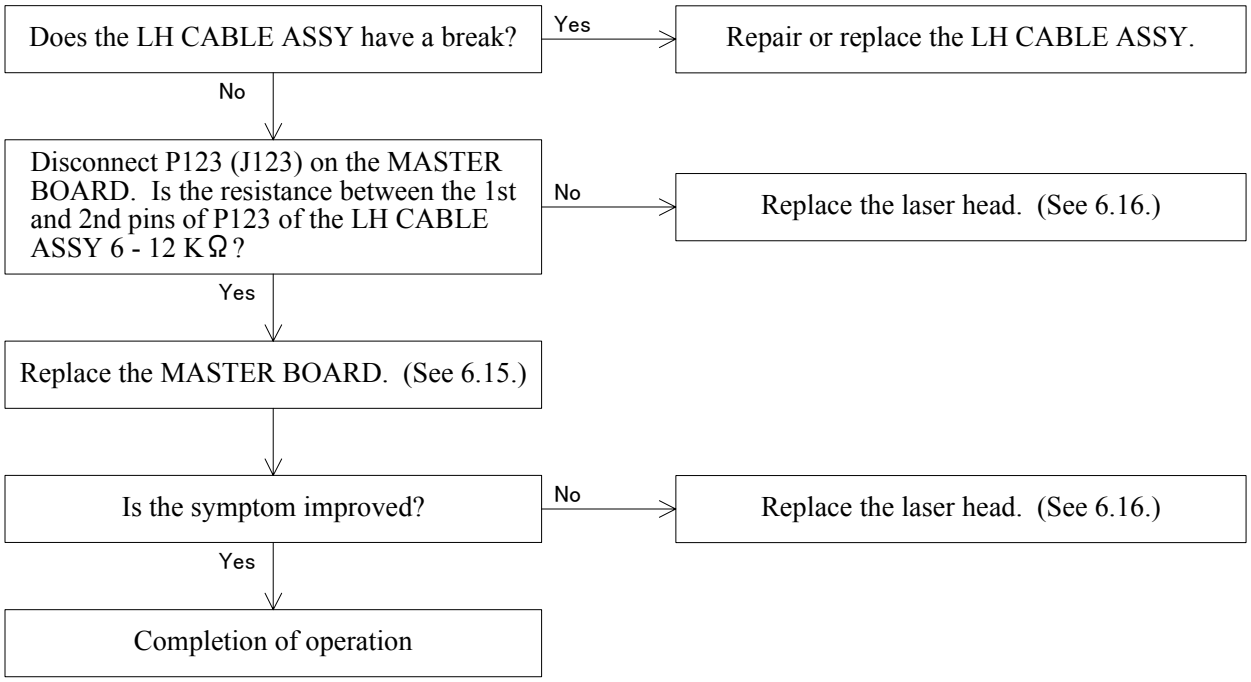
4.5 Error 3 appears.


Does the AIMING SHUTTER ASSY (EA03) have a break?
Yes
Repair or replace the AIMING SHUTTER ASSY (EA03). (See 6.6.)
No
Is the AIMING SHUTTER ASSY positioned at the detectable area of the sensor?
No
Perform the position adjustment of the AIMING SHUTTER ASSY.
Yes
Is the voltage between the 3rd and 5th, 6th and 5th pins of P107 (J107) on the MASTER BOARD approximately + 1.3 DVC?
No
Replace the AIMING SHUTTER ASSY (EA03). (See 6.4.)
Yes
Is the voltage of P107 (J107) on the MASTER BOARD as follows when the aiming beam is OFF?
4th - 5th pins: 5 V
7th - 5th pins: 0 V
No
Repair or replace the AIMING SHUTTER ASSY (EA03). (See 6.6.)
Yes
Is the voltage of P107 (J107) on the MASTER BOARD as follows when the aiming beam is ON?
4th - 5th pins: 0 V
7th - 5th pins: 5 V
No
Repair or replace the AIMING SHUTTER ASSY (EA03). (See 6.6.)
Yes
Replace the MASTER BOARD.

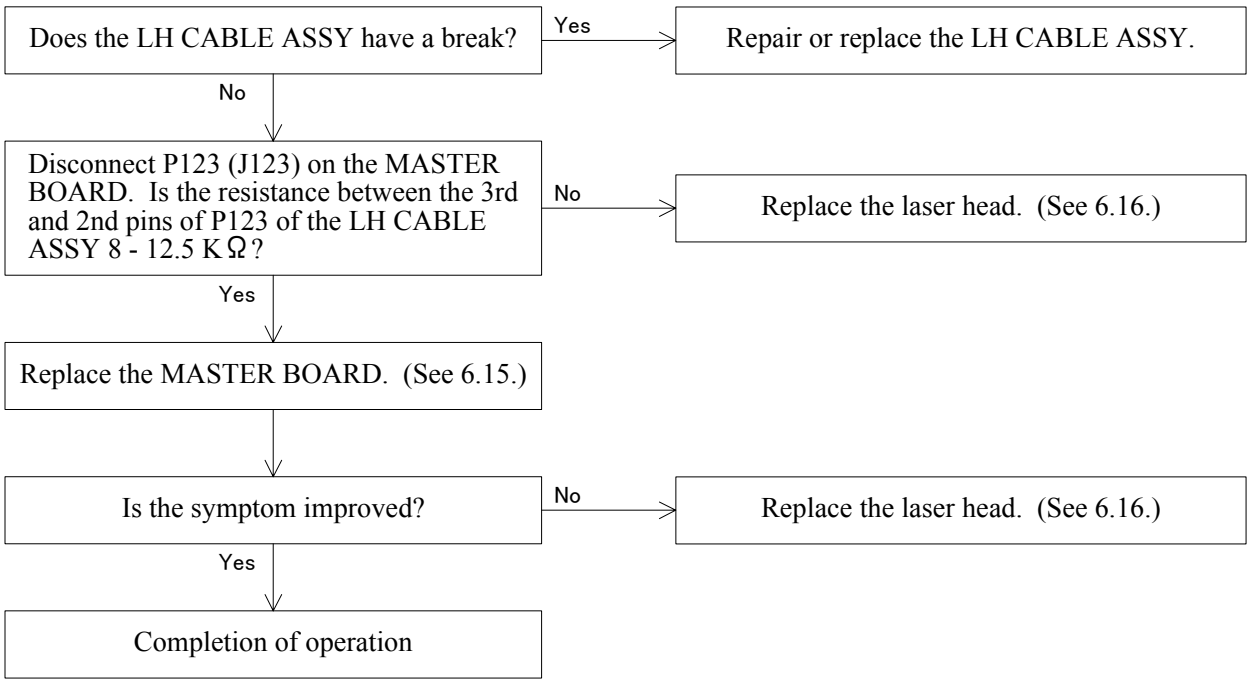
4.6 Error 13 appears.


Disconnect P113 (J113) on the MASTER BOARD. Is the circuit between the 1st and 3rd pins of P113 on the TRANSISTOR ASSY short-circuited?
Yes
Replace the TRANSISTOR ASSY. (See 6.7.)
No
Disconnect P114 (J114) on the MASTER BOARD. Is the circuit between the 1st and 3rd pins of P114 on the TRANSISTOR ASSY short-circuited?
Yes
Replace the TRANSISTOR ASSY. (See 6.7.)
No
Replace the MASTER BOARD. (See 6.15.)

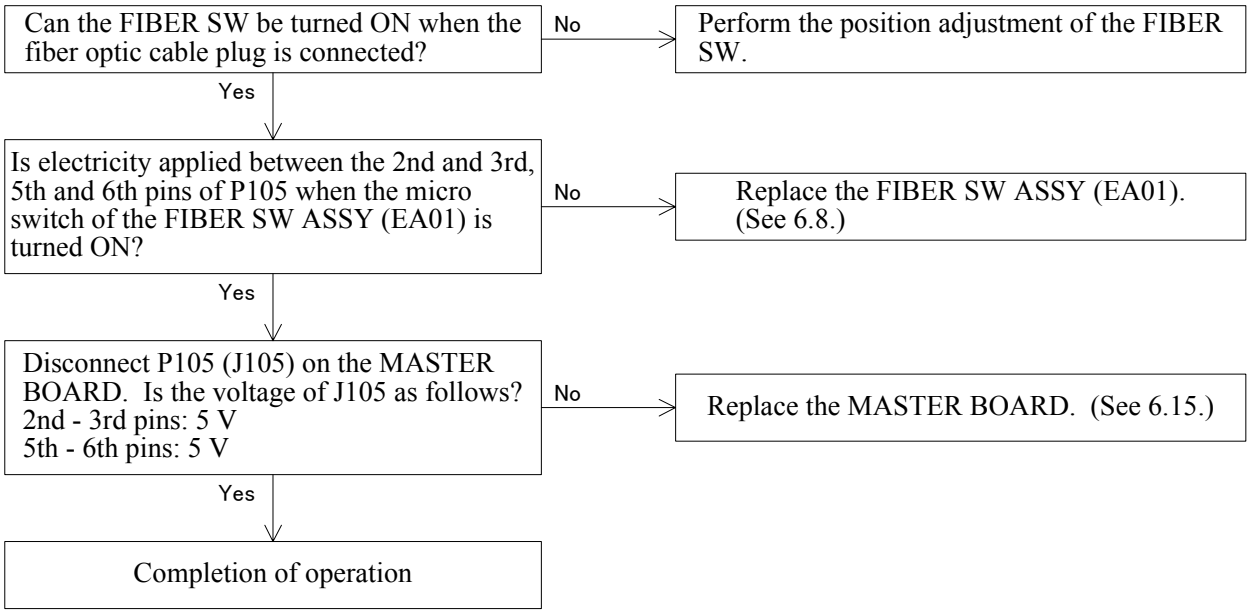
4.7 Error 20 appears.


Does the LH CABLE ASSY have a break?
Yes
Repair or replace the LH CABLE ASSY.
No
Disconnect P123 (J123) on the MASTER BOARD. Is the resistance between the 1st and 2nd pins of P123 of the LH CABLE ASSY 6 - 12 KΩ?
No
Replace the laser head. (See 6.16.)
Yes
Replace the MASTER BOARD. (See 6.15.)
Is the symptom improved?
No
Replace the laser head. (See 6.16.)
Yes
Completion of operation

4.8 Error 21 appears.


Does the LH CABLE ASSY have a break?
Yes
Repair or replace the LH CABLE ASSY.
No
Disconnect P123 (J123) on the MASTER BOARD. Is the resistance between the 3rd and 2nd pins of P123 of the LH CABLE ASSY 8 - 12.5 KΩ?
No
Replace the laser head. (See 6.16.)
Yes
Replace the MASTER BOARD. (See 6.15.)
Is the symptom improved?
No
Replace the laser head. (See 6.16.)
Yes
Completion of operation

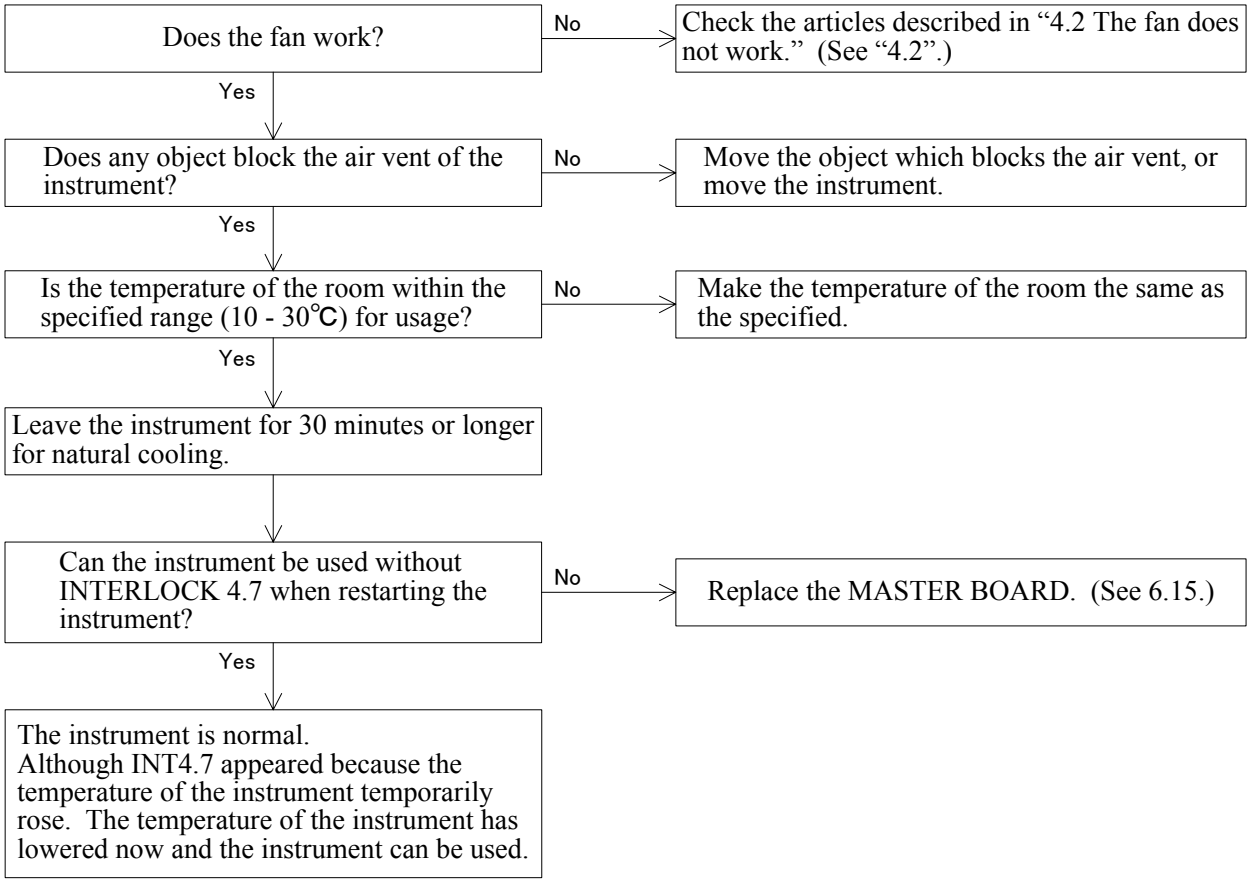
4.9 Error 54 appears.


Can the FIBER SW be turned ON when the fiber optic cable plug is connected?
No
Perform the position adjustment of the FIBER SW.
Yes
Is electricity applied between the 2nd and 3rd, 5th and 6th pins of P105 when the micro switch of the FIBER SW ASSY (EA01) is turned ON?
No
Replace the FIBER SW ASSY (EA01). (See 6.8.)
Yes
Disconnect P105 (J105) on the MASTER BOARD. Is the voltage of J105 as follows?
2nd - 3rd pins: 5 V
5th - 6th pins: 5 V
No
Replace the MASTER BOARD. (See 6.15.)
Yes
Completion of operation

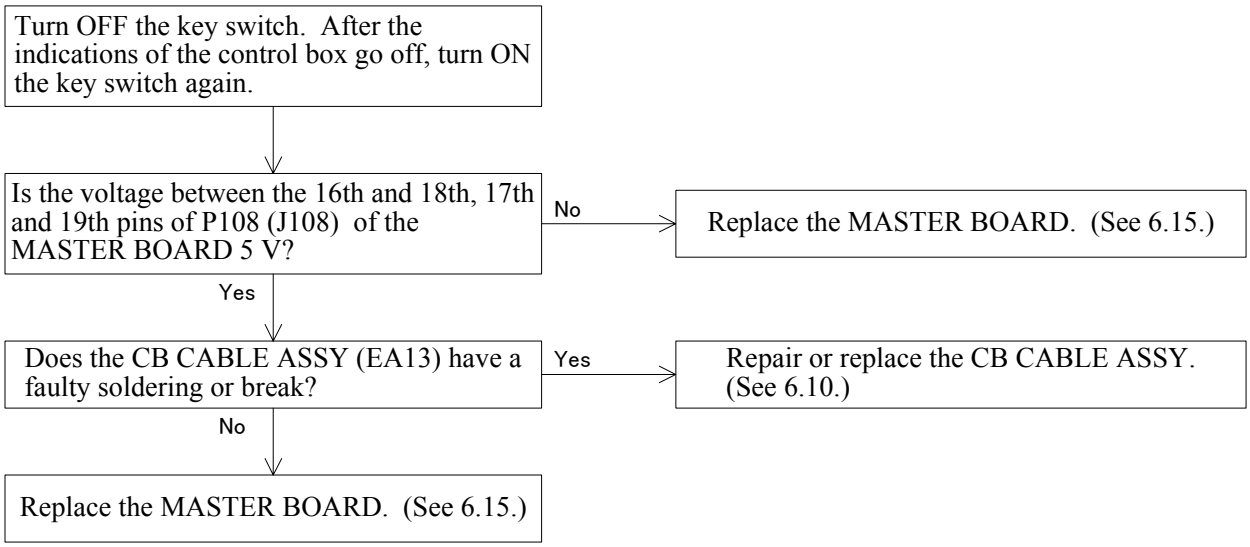
4.10 Any error in the 90s appears.

Replace the MAIN CPU (17164-E150) and SUB CPU (17164-E160). (See 6.9.)

4.11 INTERLOCK 4.7 appears.


Does the fan work?
No
Check the articles described in “4.2 The fan does not work.” (See “4.2”.)
Yes
Does any object block the air vent of the instrument?
No
Move the object which blocks the air vent, or move the instrument.
Yes
Is the temperature of the room within the specified range (10 - 30℃) for usage?
No
Make the temperature of the room the same as the specified.
Yes
Leave the instrument for 30 minutes or longer for natural cooling.
Can the instrument be used without INTERLOCK 4.7 when restarting the instrument?
No
Replace the MASTER BOARD. (See 6.15.)
Yes
The instrument is normal.
Although INT4.7 appeared because the temperature of the instrument temporarily rose. The temperature of the instrument has lowered now and the instrument can be used.

4.12 The coagulation power cannot be changed.


Turn OFF the key switch. After the indications of the control box go off, turn ON the key switch again.
Is the voltage between the 16th and 18th, 17th and 19th pins of P108 (J108) of the MASTER BOARD 5 V?
No
Replace the MASTER BOARD. (See 6.15.)
Yes
Does the CB CABLE ASSY (EA13) have a faulty soldering or break?
Yes
Repair or replace the CB CABLE ASSY. (See 6.10.)
No
Replace the MASTER BOARD. (See 6.15.)

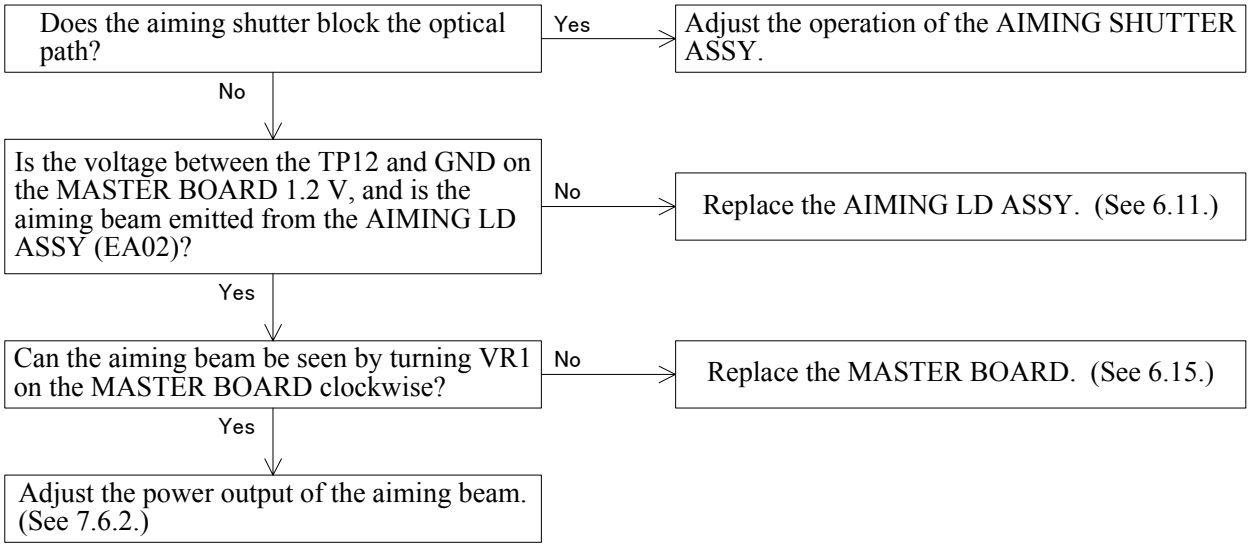
4.13 The coagulation time cannot be changed.

Check and perform the articles described in 4.12.

4.14 The brightness of the aiming beam cannot be changed.

Check and perform the articles described in 4.12.

4.15 The aiming beam is invisible.


Does the aiming shutter block the optical path?
Yes
Adjust the operation of the AIMING SHUTTER ASSY.
No
Is the voltage between the TP12 and GND on the MASTER BOARD 1.2 V, and is the aiming beam emitted from the AIMING LD ASSY (EA02)?
No
Replace the AIMING LD ASSY. (See 6.11.)
Yes
Can the aiming beam be seen by turning VR1 on the MASTER BOARD clockwise?
No
Replace the MASTER BOARD. (See 6.15.)
Yes
Adjust the power output of the aiming beam. (See 7.6.2.)

4.16 The interval time cannot be changed.

Check and perform the articles described in 4.12.

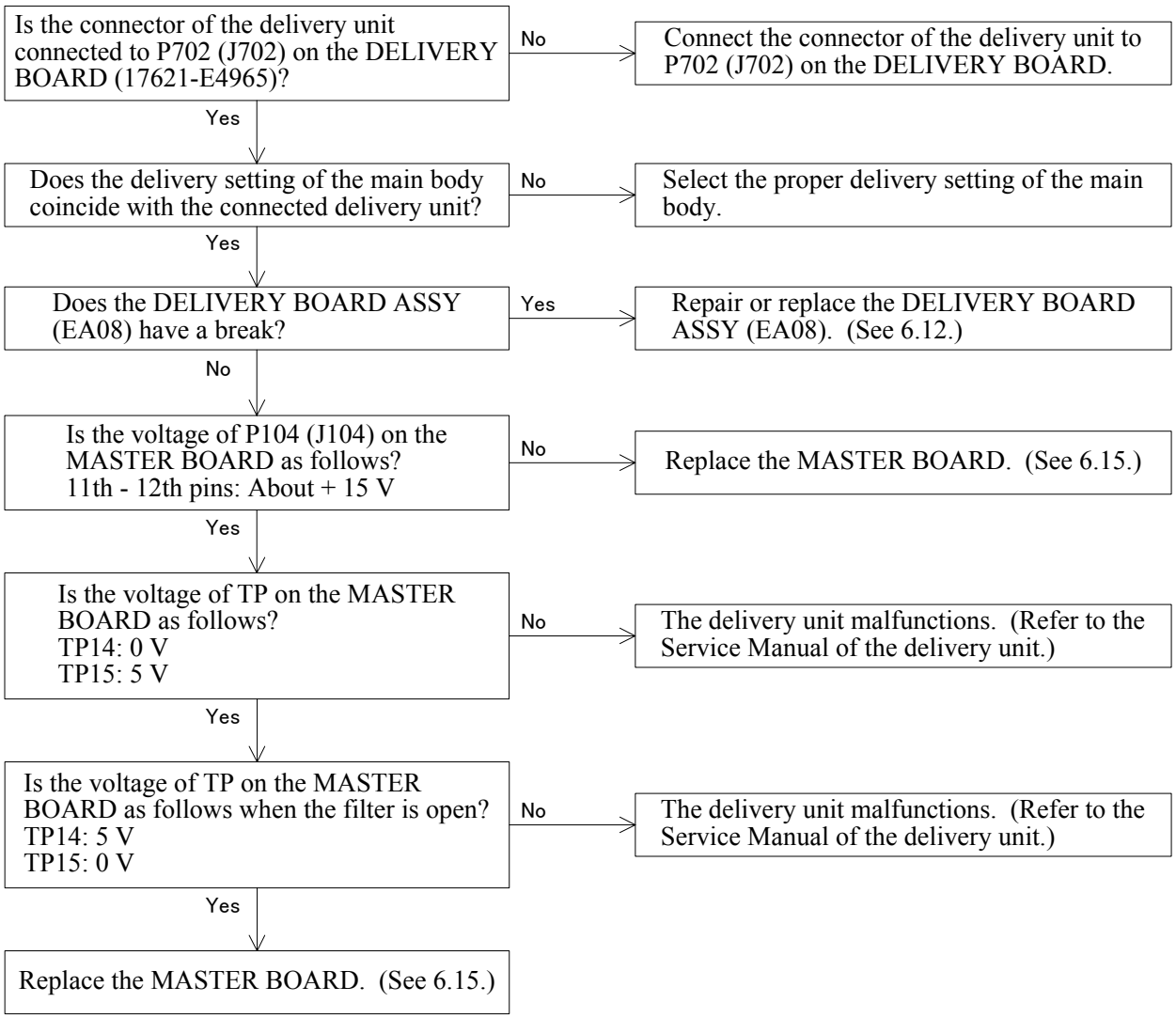
4.17 The READY indicator does not light up.

Check and perform the articles described in 4.12.

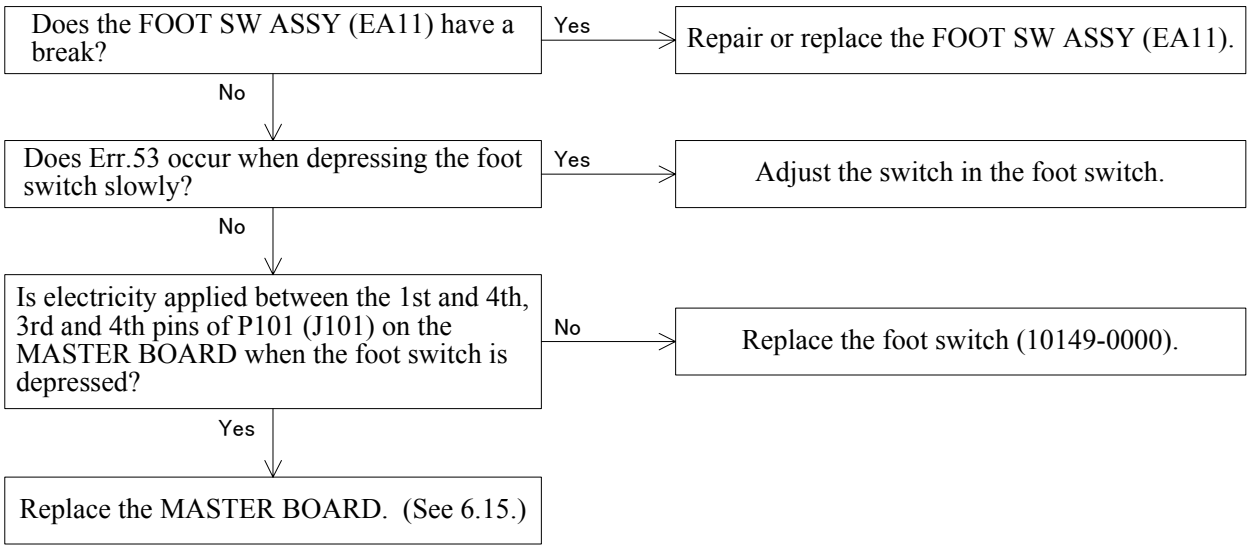
4.18 The counter cannot be reset.

Check and perform the articles described in 4.12.

4.19 Error 2 appears.


Is the connector of the delivery unit connected to P702 (J702) on the DELIVERY BOARD (17621-E4965)?
No
Connect the connector of the delivery unit to P702 (J702) on the DELIVERY BOARD.
Yes
Does the delivery setting of the main body coincide with the connected delivery unit?
No
Select the proper delivery setting of the main body.
Yes
Does the DELIVERY BOARD ASSY (EA08) have a break?
Yes
Repair or replace the DELIVERY BOARD ASSY (EA08). (See 6.12.)
No
Is the voltage of P104 (J104) on the MASTER BOARD as follows?
11th - 12th pins: About + 15 V
No
Replace the MASTER BOARD. (See 6.15.)
Yes
Is the voltage of TP on the MASTER BOARD as follows?
TP14: 0 V
TP15: 5 V
No
The delivery unit malfunctions. (Refer to the Service Manual of the delivery unit.)
Yes
Is the voltage of TP on the MASTER BOARD as follows when the filter is open?
TP14: 5 V
TP15: 0 V
No
The delivery unit malfunctions. (Refer to the Service Manual of the delivery unit.)
Yes
Replace the MASTER BOARD. (See 6.15.)

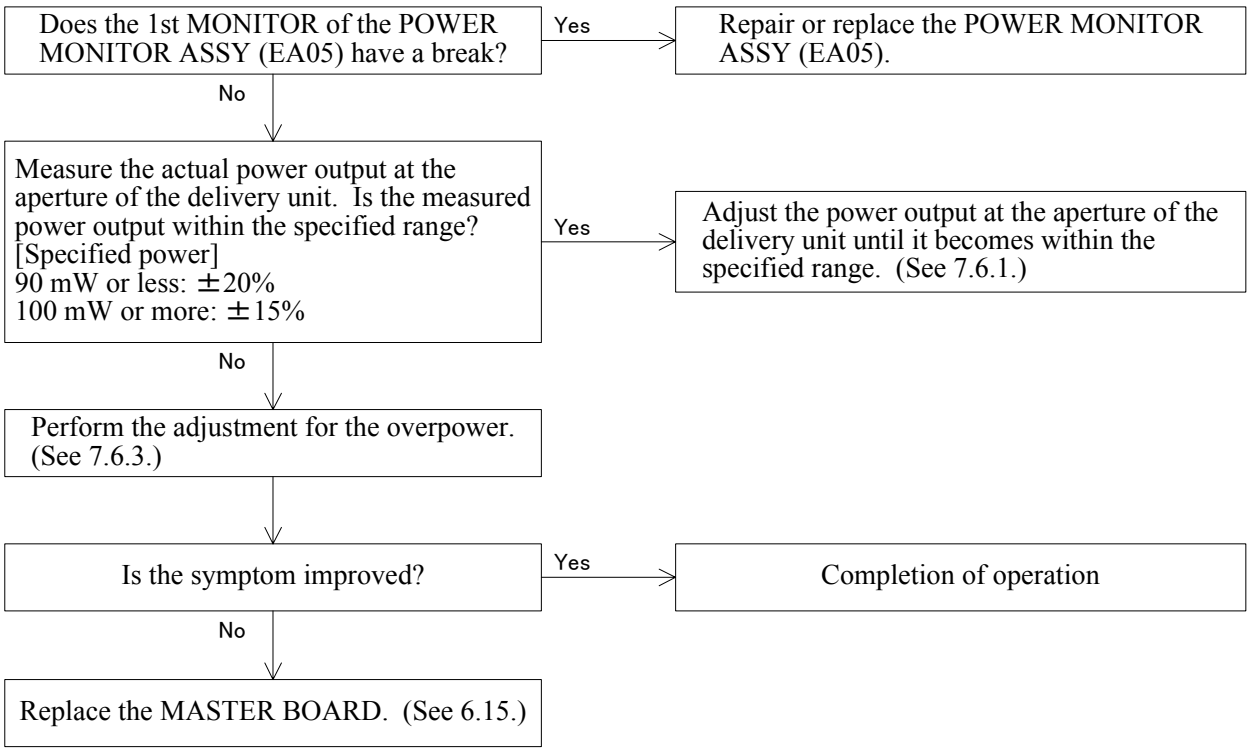
4.20 Error 53 appears.


Does the FOOT SW ASSY (EA11) have a break?
Yes
Repair or replace the FOOT SW ASSY (EA11).
No
Does Err.53 occur when depressing the foot switch slowly?
Yes
Adjust the switch in the foot switch.
No
Is electricity applied between the 1st and 4th, 3rd and 4th pins of P101 (J101) on the MASTER BOARD when the foot switch is depressed?
No
Replace the foot switch (10149-0000).
Yes
Replace the MASTER BOARD. (See 6.15.)

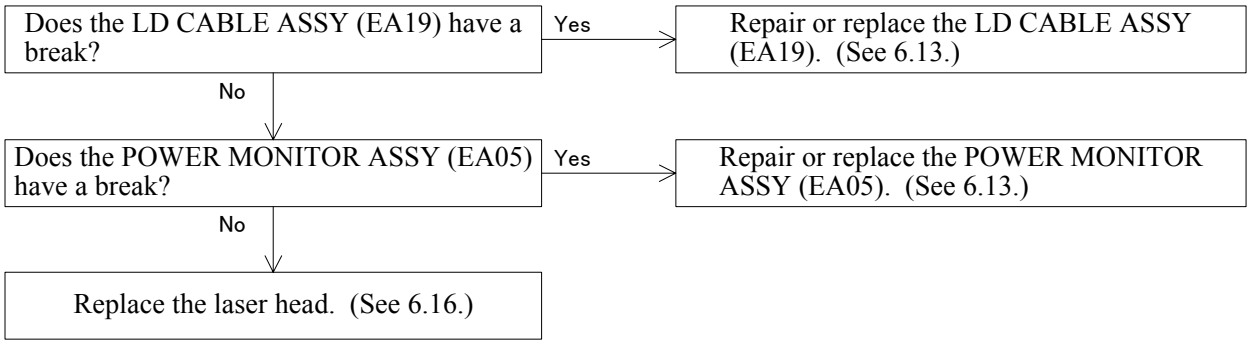
4.21 Error 55 appears.

Check and perform the articles described in 4.19.

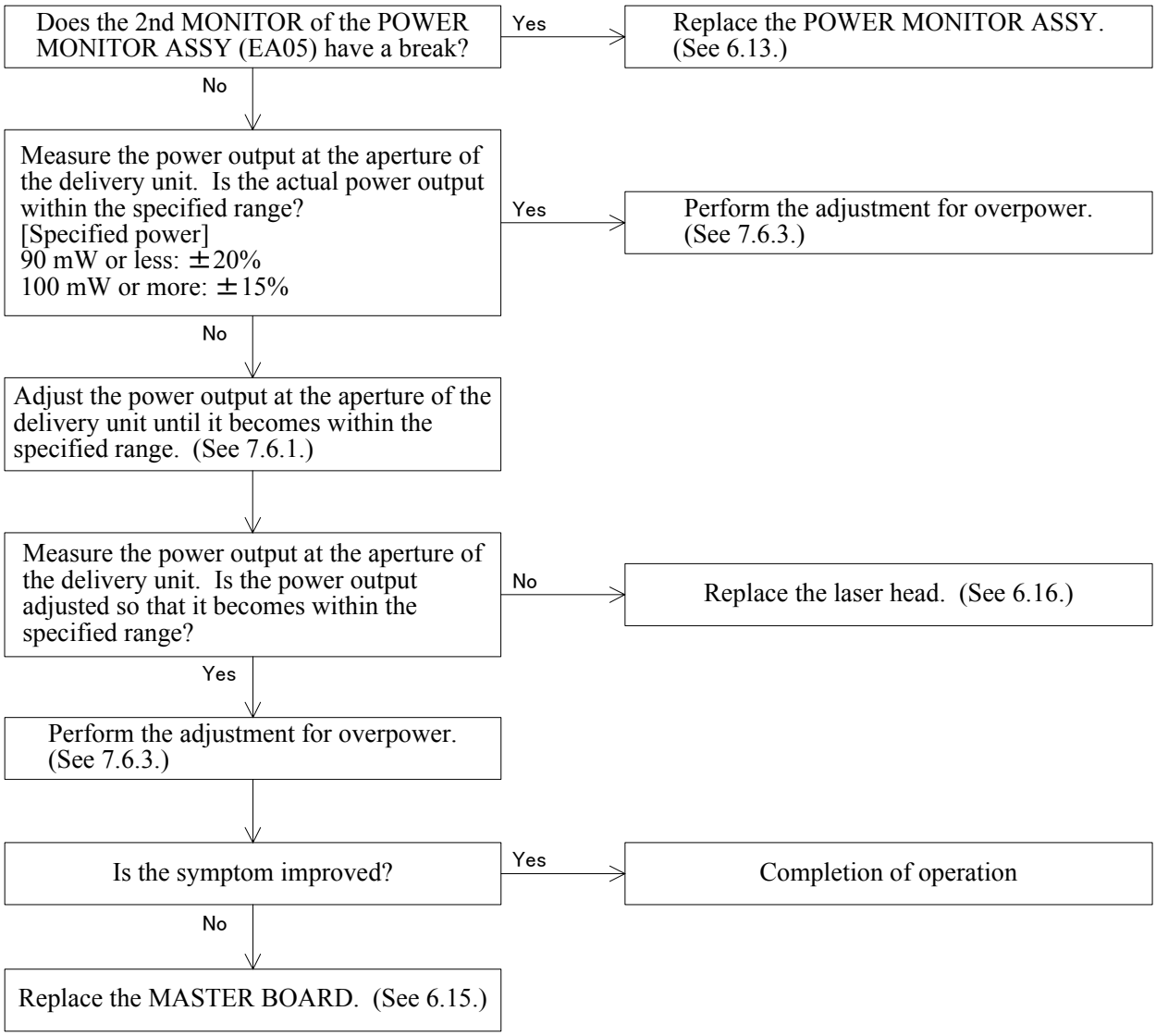
4.22 INTERLOCK 2.7 appears.


Does the 1st MONITOR of the POWER MONITOR ASSY (EA05) have a break?
Yes
Repair or replace the POWER MONITOR ASSY (EA05).
No
Measure the actual power output at the aperture of the delivery unit. Is the measured power output within the specified range?
[Specified power]
90 mW or less: ±20%
100 mW or more: ±15%
Yes
Adjust the power output at the aperture of the delivery unit until it becomes within the specified range. (See 7.6.1.)
No
Perform the adjustment for the overpower. (See 7.6.3.)
Is the symptom improved?
Yes
Completion of operation
No
Replace the MASTER BOARD. (See 6.15.)

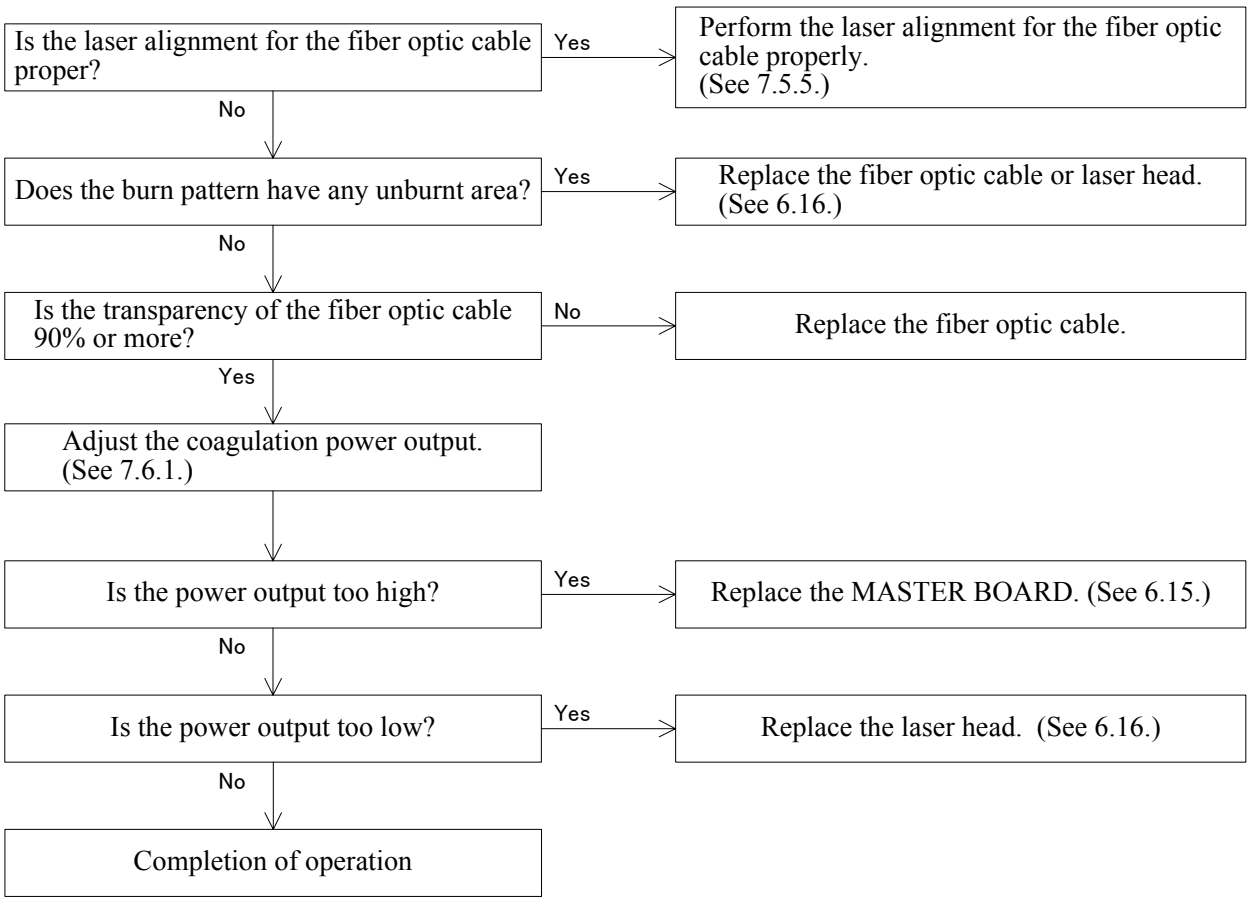
4.23 Error 10 appears.


Does the LD CABLE ASSY (EA19) have a break?
Yes
Repair or replace the LD CABLE ASSY (EA19). (See 6.13.)
No
Does the POWER MONITOR ASSY (EA05) have a break?
Yes
Repair or replace the POWER MONITOR ASSY (EA05). (See 6.13.)
No
Replace the laser head. (See 6.16.)

4.24 Error 15 appears.


Does the 2nd MONITOR of the POWER MONITOR ASSY (EA05) have a break?
Yes
Replace the POWER MONITOR ASSY. (See 6.13.)
No
Measure the power output at the aperture of the delivery unit. Is the actual power output within the specified range?
[Specified power]
90 mW or less: ±20%
100 mW or more: ±15%
Yes
Perform the adjustment for overpower. (See 7.6.3.)
No
Adjust the power output at the aperture of the delivery unit until it becomes within the specified range. (See 7.6.1.)
Measure the power output at the aperture of the delivery unit. Is the power output adjusted so that it becomes within the specified range?
No
Replace the laser head. (See 6.16.)
Yes
Perform the adjustment for overpower. (See 7.6.3.)
Is the symptom improved?
Yes
Completion of operation
No
Replace the MASTER BOARD. (See 6.15.)

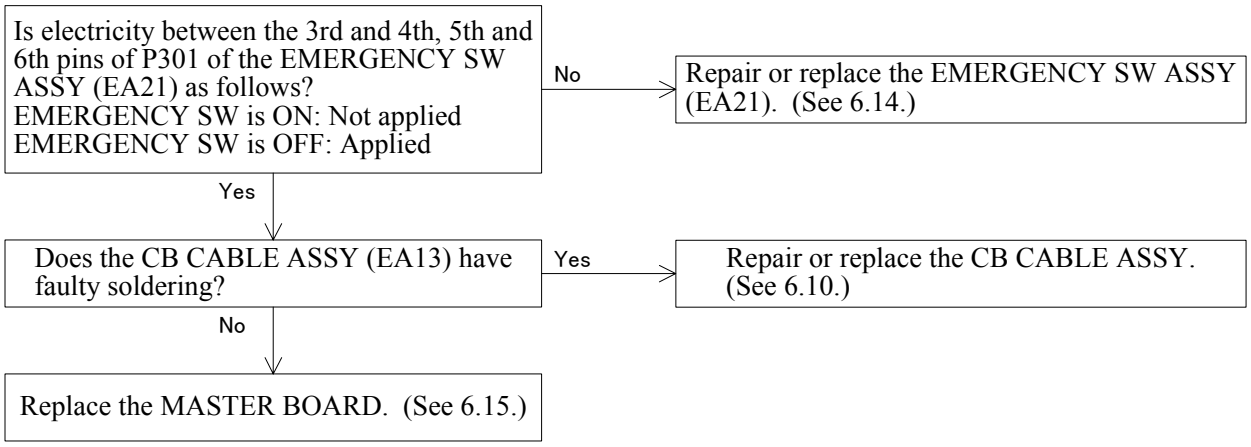
4.25 The power output is out of the specified range.


Is the laser alignment for the fiber optic cable proper?
Yes
Perform the laser alignment for the fiber optic cable properly. (See 7.5.5.)
No
Does the burn pattern have any unburnt area?
Yes
Replace the fiber optic cable or laser head. (See 6.16.)
No
Is the transparency of the fiber optic cable 90% or more?
No
Replace the fiber optic cable.
Yes
Adjust the coagulation power output. (See 7.6.1.)
Is the power output too high?
Yes
Replace the MASTER BOARD. (See 6.15.)
No
Is the power output too low?
Yes
Replace the laser head. (See 6.16.)
No
Completion of operation

4.26 When the spot size is set to 50µm, the power output is out of the specified range.

Adjust the power output when the spot size is set to 50µm. (See 7.6.1.)

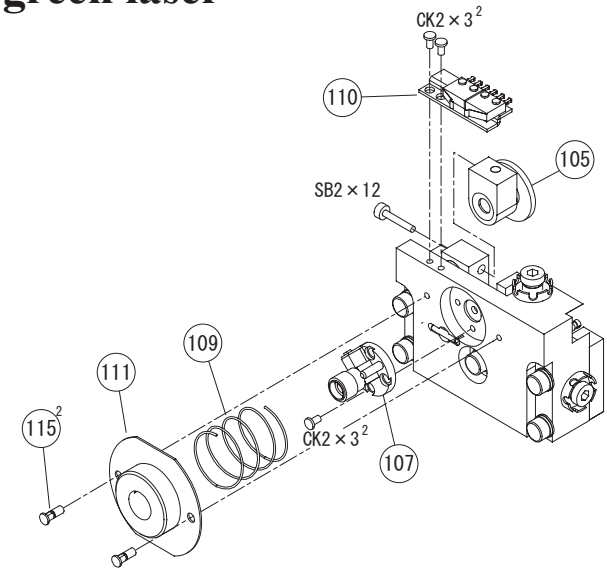
4.27 The emergency stop switch cannot be activated.


Is electricity between the 3rd and 4th, 5th and 6th pins of P301 of the EMERGENCY SW ASSY (EA21) as follows?
EMERGENCY SW is ON: Not applied
EMERGENCY SW is OFF: Applied
No
Repair or replace the EMERGENCY SW ASSY (EA21). (See 6.14.)
Yes
Does the CB CABLE ASSY (EA13) have faulty soldering?
Yes
Repair or replace the CB CABLE ASSY. (See 6.10.)
No
Replace the MASTER BOARD. (See 6.15.)

7.5 Optical adjustment

7.5.1 Optical axis adjustment of green laser

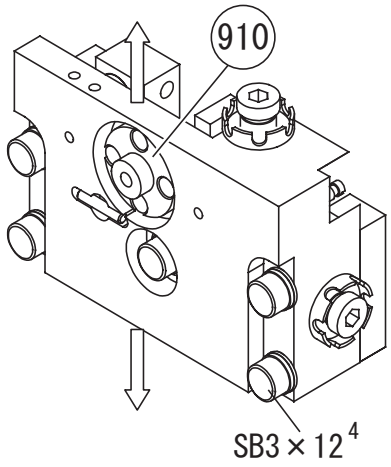
1. Remove the following parts of the CONDENSER ASSY (17164-1700) according to the right figure.
(a) Mount (17164-M110)
(b) Receptacle (17164-M107)
(c) Plate (17164-M111)
(d) Pin (17164-M115)
(e) Base (17164-M105)
(f) Spring (17164-M109)



2. Connect the clamp tester to the 2 BRN cables of J117 (+5V PS ASSY: 17164-EA16) on the MASTER BOARD (17164-BA01). Set DIP SW No. 6 on the CB (17164-BA03) to the OFF position, and turn ON the master and key switches.

3. Set the power meter (COHERENT, Model 201) to the laser beam window (receptacle of the main body).

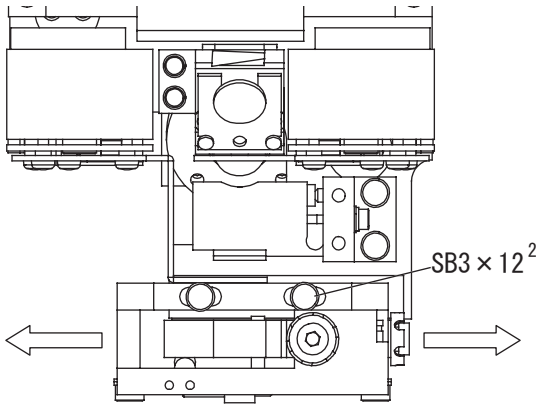
4. Adjust the current by pressing the POWER switch on the CB so that the clamp tester reads the same current as the one (2.5W) in the Shipping Record when emitting the laser. At the same time, verify that the power meter reads 2.3W or more.



Vertical position adjustment

5. Attach the near point optical axis calibration jig (19344-M910) to the attached position of the receptacle (17164-M107).

6. Loosen SB3×12 (n=6) (illustrated on the right figure), and adjust the vertical and horizontal positions so that the optical axis of the green laser coincides with the center of the near point optical axis calibration jig.

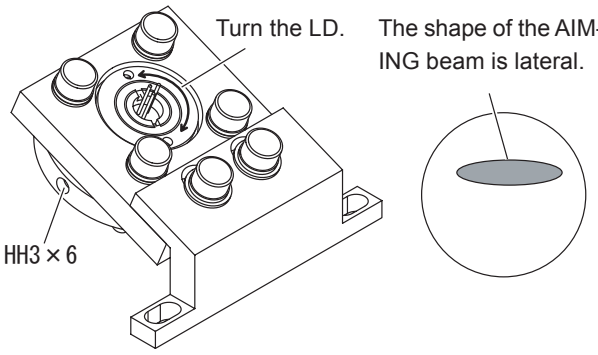


Horizontal position adjustment

7.5.2 Optical axis adjustment of aiming beam

1. Loosen HH3×6 and turn the LD (17164-EA02) to adjust the optical axis of the aiming beam so that the shape of the aiming beam becomes lateral as illustrated on the right when matching the aiming beam position to the near point optical axis calibration jig (19433-M910).

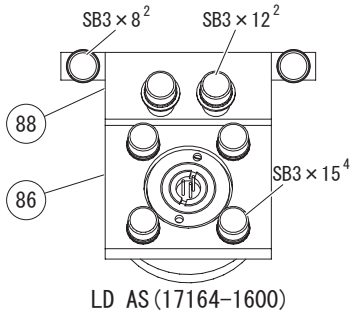
* The optical axis adjustment of the aiming beam described above is a rough adjustment.



7.5.2.1 Near point confocal adjustment

1. Follow the instructions below to adjust the LD ASSY (17164-1600) so that the optical axis of the aiming beam coincides with the center of the near point optical axis calibration jig (19433-M910) and so it coincides with the green laser coaxially.

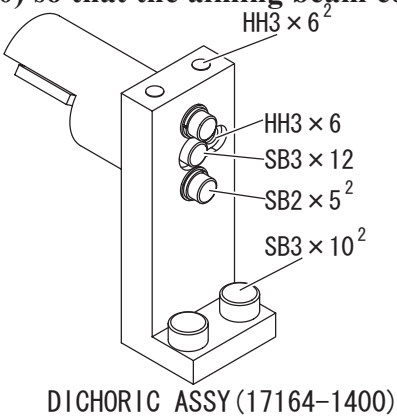
(1) Loosen SB3×8 (n=2) and adjust the horizontal position of the LD ASSY (17164-1600) at the position of the base (17164-M088).
(2) Loosen SB3×12 (n=2) and adjust the vertical position of the LD ASSY (17164-1600).
(3) Fasten and unfasten SB3×15 (n=4), and finely adjust the vertical and horizontal position of the LD ASSY (17164-1600).



7.5.2.2 Far point confocal adjustment

1. Emit the laser to a wall that is 1m or more away from the instrument. Follow the instructions below to adjust the DICHROIC ASSY (17164-1400) so that the aiming beam coincides with the green laser coaxially.

(1) Loosen SB3×10 (n=2) and move the DICHORIC ASSY horizontally, forward and backward to adjust the position of the DICHORIC ASSY (17164-1400) with the play of the screw.
(2) Loosen SB2×5 (n=2), and fasten and unfasten HH3×6 (n=2) to adjust the horizontal position of the DICHORIC ASSY (17164-1400).
(3) Fasten and unfasten HH3×6 and SB3×12 to adjust the vertical position of the DICHORIC ASSY (17164-1400).



2. Perform the near point (see 7.5.2.1) and far point confocal adjustment repeatedly so that the aiming beam coincides with the green laser coaxially at the near point and far point.

7.5.3 1W and 1V adjustment

1. Remove the parts of the CONDENSER ASSY (17164-1700) that are the same as the parts removed in 7.5.1. (See 7.5.1.)
   * Before removing the parts, verify that the optical axis of the green laser coincides with the center of the near point optical axis calibration jig (19433-M910). (See 7.5.1.)

2. Turn OFF the master and key switches. Connect the oscilloscope between TP8 and TP9, and turn ON the master and key switches.

3. Press the POWER switch on the CB to set the laser power so that the power at the end of the laser becomes 1000mW when emitting the laser.

4. Follow the instructions below to adjust the voltage so that the voltage of TP8 and TP9 becomes 1V when emitting the laser.
   (a) Voltage of TP8: Adjust it with VR6 on the MASTER BOARD (17164-B01).
   (b) Voltage of TP9: Adjust it with VR3 on the MASTER BOARD (17164-BA01).
   * If the voltage cannot be adjusted to 1V, remove the MONITOR ASSY (17164-1200) from the bench (17164-M001), insert 3PW3 (n=2) between the MONITOR ASSY (17164-1200) and bench (17164-M001), and adjust the position of the MONITOR ASSY (17164-1200). Then, check the voltage again.

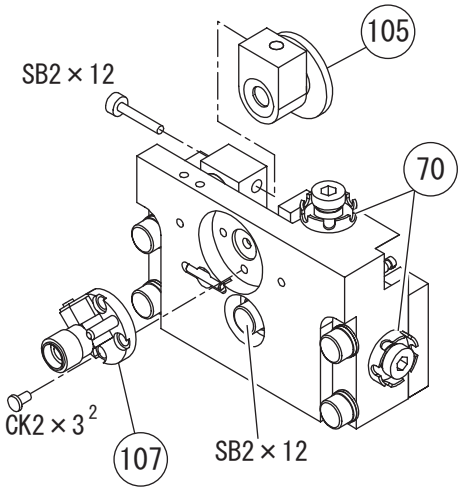
5. Set DIP SW No. 1 and 2 on the CB (17164-BA03) to the OFF position.

6. Connect the oscilloscope to TP8 on the MASTER BOARD (17164-BA01).

7. Verify that the waveform of TP8 by the oscilloscope does not have any overshooting, noise etc. when emitting the laser at the POWER of 500mW and 50mW.

8. Set DIP SW No. 1 and 2 on the CB (17164-BA03) to the ON position.

7.5.4 Condenser adjustment



1. Attach the receptacle (17164-M107) that was removed in the green laser optical axis adjustment. (See 7.5.1.)

2. Set the power meter (COHERENT Model 201) in front of the laser beam window of the main body. Press the POWER switch on the CB to adjust the laser power so that the power meter reads 500mW. Take notes of the measured power and the power on the POWER display of the CB.

3. Connect the condensed laser magnification jig (19344-9100) to the FIBER connector (receptacle: 17164-M107) of the main body.

4. Loosen SB3×12 and lock rings (17162-M070, n=2) of the adjustment screws (17164-M112, n=2).

5. First, lower the laser power by pressing the POWER switch, then gradually increase it until the laser slightly lights up.

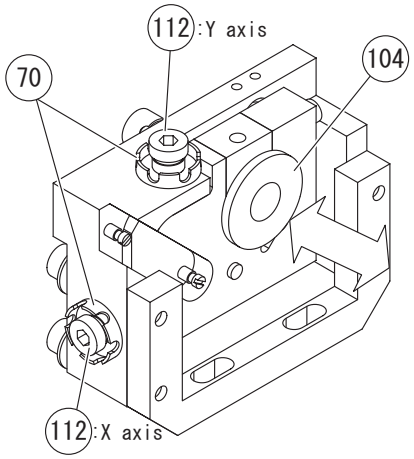
6. Emit the laser and turn the adjustment screws (17164-M112, n=2) so that the position of the green laser coincides with the center of the condensed laser magnification jig (19433-9100).

7. Connect the fiber optic cable to the base (17164-M105) and FIBER connector of the main body (receptacle: 17164-M107) together with the condenser. Set the power meter to the end of the fiber optic cable.

8. Set the POWER of the CB to the same power as in step 2.

9. Emit the laser and follow the instructions below to adjust the adjustment screw of each axis and holder so that the power meter reads the maximum power.

(1) Turn the adjustment screw for the X axis (17164-M112) to adjust its position so that the power meter reads the maximum power.
(2) Turn the adjustment screw for the Y axis (17164-M112) to adjust its position so that the power meter reads the maximum power.
(3) Push and draw out the holder to adjust its position so that the power meter reads the maximum power.
(4) Repeat steps (1) to (4).



10. Emit the laser and verify that the power measured by the power meter is 90% or more of the power obtained in step 2.
* If it is not, perform step 9 again.

11. Make the fiber optic cable turn one rotation at 90 degree intervals. Verify that the measured power at every 90 degrees is 90% or more of the power obtained in step 10.
* If it is not, perform step 9 again.

12. Screw SB3×12 and lock rings (17162-M070) of the adjustment screws (17164-M112). Then, perform steps 10 and 11 again.

13. After the condenser adjustment is completed, reassemble the plate (17164-M111), pin (17164-M115), mount (17164-M110) and spring (17164-M109).

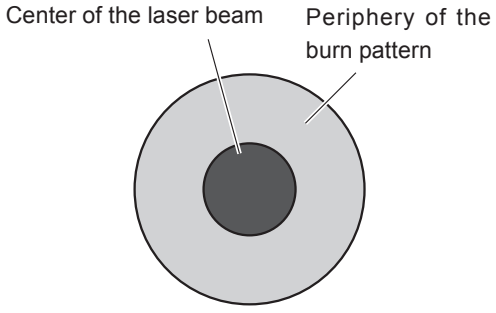
7.5.5 Laser alignment for the fiber optic cable

* Follow the instructions below to perform the laser alignment for the fiber optic cable only when the laser alignment for the fiber optic cable has shifted.

1. Loosen SB3×12 and lock rings (17164-M070). (See 7.5.4.)

2. Attach the fiber optic cable to the CONDENSER ASSY (17164-1700), set the laser power output to 500mW and emit the laser onto a wall etc.

3. Turn the adjustment screws for the X and Y axes (17164-M112) so that the periphery of the burn pattern on the wall etc. fades out (lightly burnt).



4. Set the power meter to the end of the fiber optic cable.

5. Turn the adjustment screws for the X and Y axes (17164-M112) to adjust the position so that the power meter reads the maximum.

6. Perform step 5 repeatedly to adjust the position finely so that the power meter reads the maximum laser power.

7. Make the fiber optic cable turn one rotation at 90 degree intervals. Verify that the measured power at every 90 degrees is 90% or more of the power obtained in step 6.

8. Tighten SB3×12 and the lock rings (17164-M112) of the adjustment screws. Then, perform step 7 and verify that the measured power is 90% or more.
* If it is not, repeat steps 5 to 8.

7.6 Total adjustment

7.6.1 Adjustment of the light control

1. Set DIP SW No. 1 and 2 on the CB to the OFF position, and No. 3 to 8 to the ON position.
2. Detach the fiber optic cable and set the value of parameter address 24 to "100". (See 7.1.)
3. Attach the fiber optic cable and set the power meter (COHERENT Model 201) to the end of the fiber optic cable.
4. Follow the instructions below to adjust the POWER display of the CB and the power measured by the power meter when the POWER display of the CB is 50mW and 500mW.
At the power of 500mW: Adjust the value with VR3 on the MASTER BOARD (17164-BA01).
At the power of 50mW: Adjust the value with parameter address 18.
* Firstly, perform the adjustment at the power of 500mW. Then, perform the adjustment both at the power of 500mW and 50mW so that the POWER display of the CB and the measured power do not shift.
5. Turn OFF the key switch and attach the fiber optic cable of each delivery unit to the main body.
6. Set the power meter (COHERENT Model 201) to each delivery unit.
7. Measure the power output of each delivery unit when the POWER display of the CB is 500mW. Follow the instructions below to adjust the power so that the measured power becomes 500mW ± 15%.
(1) Set DIP SW No. 6 of the CB to the OFF position.
(2) Change the parameters below. (See 7.1.)

SL-130 delivery unit	: Parameter address 20
SL-1600/30SL delivery unit	: Parameter address 21
Other delivery units	: Parameter address 23
ENDO delivery unit	: Parameter address 24
BIO delivery unit	: Parameter address 26
HAAG delivery unit	: Parameter address 27
COMBO delivery unit	: Parameter address 28

(3) Set DIP SW No. 6 of the CB to the ON position.
(4) Measure the power output again, repeat steps (1) to (4) until the power output becomes 500mW ± 15%.
* Set the spot size of each delivery unit to the maximum.
* If the power output is 500mW ± 15%, it is not necessary to change the parameters.
8. Measure the power output when the POWER display of the CB is 100 to 1700mW.
9. Adjust the power output with the parameter addresses 30 to 46 as in the right table so that the power output becomes 100 - 1700mW ± 15%. (See 7.1.)
* Set the spot size of each delivery unit to the maximum.

Power of the fiber optic cable	Address
At 100mW	30
At 200mW	31
At 300mW	32
At 400mW	33
At 500mW	34
At 600mW	35
At 700mW	36
At 800mW	37
At 900mW	38
At 1000mW	39
At 1100mW	40
At 1200mW	41
At 1300mW	42
At 1400mW	43
At 1500mW	44
At 1600mW	45
At 1700mW	46

10. **Measure the power output when the POWER display of the CB is 50mW, and adjust it with parameter address 18 so that it becomes 50mW ± 20%. (See 7.1.)**
11. **Set the spot size of each delivery unit to the minimum, and measure the power output when the POWER display of the CB is 50mW.**
12. **Adjust the power output with the parameter addresses below so that the measured power becomes 500mW ± 15%. (See 7.1.)**
    SL-1600/30SL delivery unit : Parameter address 80
    SL130 delivery unit : Parameter address 81
    HAAG delivery unit : Parameter address 82
13. **Verify that the power output is within the specified range for all conditions (spot size, POWER display of the CB).**
14. **Compensate for a shift in the power output according to the spot size by changing the parameter values finely until the power output becomes within the specified range.**
15. **Set the POWER display of the CB to 1700mW. Verify that the rising voltage of TP8 is within the range of the stable voltage ± 20% when depressing the foot switch.**
16. **After the adjustment is completed, set all the DIP switches of the CB (17164-BA03) to the ON position.**

7.6.2 Power adjustment of the aiming beam

1. **Set the power meter (LASER MATE Q 0217-050-00) to the delivery unit, and multimeter between TP12 on the MASTER BOARD (17164-BA01) and GND. Set the AIMING display of the CB and the spot size of each delivery unit to the maximum.**
2. **Adjust the optical axis of the aiming beam again while checking the power meter so that the power of the aiming beam becomes the maximum. (See 7.6.2.)**
3. **Adjust the power with VR1 on the MASTER BOARD (17164-BA01) so that the power output of the aiming beam becomes 0.3mW.**
4. **Verify that the voltage (obtained by the multimeter) between TP12 on the MASTER BOARD (17164-BA01) and GND is 1V or less.**
   * The voltage is normally about 0.5V or so.
5. **Set the AIMING display of the CB to the minimum. Change the value of parameter address 19 so that the power output of the aiming beam becomes 0.01mW or less. (See 7.1.)**
6. **Set the AIMING display of the CB to the minimum again. Verify that the power output of the aiming beam is 0.3mW. If not, perform steps 3 to 5.**
7. **Turn the fiber optic cable 360 degree and verify that the power varies within the range of ± 10%.**
8. **A shift in the POWER according to the spot size can be compensated for with the parameter.**
9. **Measure the power output of the aiming beam when the spot size is set to the maximum and minimum. Verify that the power output of the aiming beam is within the specified range for all conditions.**

7.6.3 Adjustment for overpower

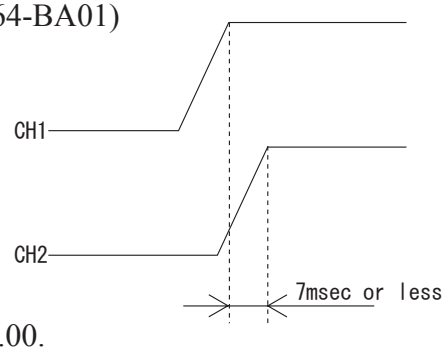
7.6.3.1 Adjustment at 1000mW

1. Set DIP SW No. 1, 2 of the CB to the OFF and No. 3 to 8 to the ON position.

2. Turn OFF the master and key switches. Set the oscilloscope by following the instructions below and turn ON the master and key switches.
CH1: TP4 on the MASTER BOARD (17164-BA01)
CH2: IC1 77th pin on the MASTER BOARD (17164-BA01)

3. Set the value of parameter address 57 to "9". (See 7.1.)

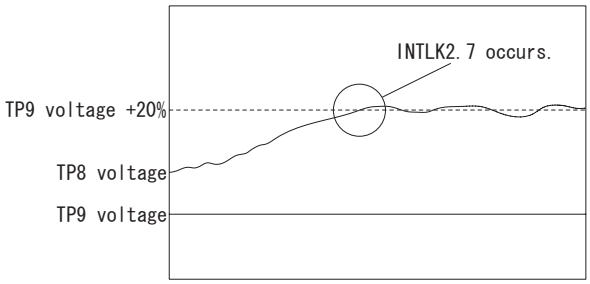
4. Emit the laser at the POWER of 50mW and observe the waveform with the oscilloscope. Verify that the time-lag between CH1 and CH2 (when the signal becomes high) is 7 msec. or less.
* Perform steps 3 and 4 only for the program Ver. 1.00.



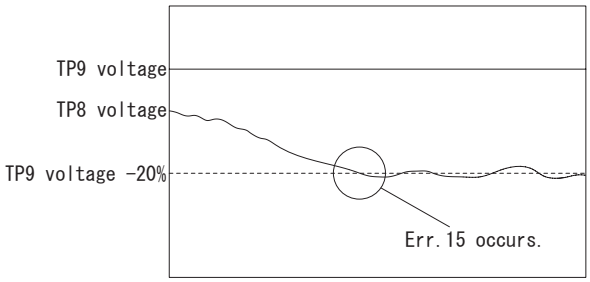
5. Turn OFF the master and key switches. Set the oscilloscope by following the instructions below, and turn ON the master and key switches.
CH1: TP9 on the MASTER BOARD (17164-BA01)
CH2: TP8 on the MASTER BOARD (17164-BA01)

6. Set the POWER display of the CB to "1000mW" and turn VR6 on the MASTER BOARD (17164-BA01) to match the TP8 voltage with the TP9 voltage when emitting the laser.
* The TP9 voltage is fixed.

7. Set the POWER display of the CB to "1000mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP8 voltage becomes the TP9 voltage + 20%. Adjust the value of parameter address 55 so that INTLK 2.7 (only a beep) occurs at that time. (See 7.1.)



8. Set the POWER display of the CB to "1000mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP8 voltage becomes the TP9 voltage -20%. Adjust the value of parameter address 58 so that Err. 15 (only a beep) occurs at that time. (See 7.1.)



9. Turn VR6 on the MASTER BOARD (17164-BA01) to match the TP8 voltage with the TP9 voltage when emitting the laser.

10. Set all DIP switches of the CB (17164-BA03) to the ON position.

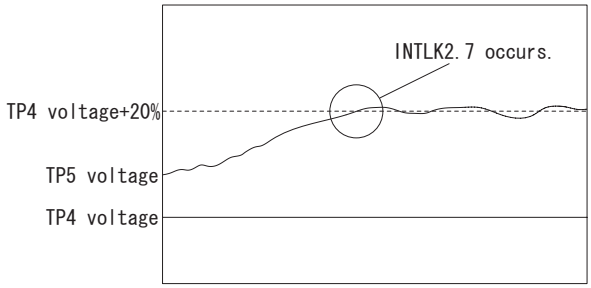
7.6.3.2 Adjustment at 50mW

1. Set DIP SW No. 1, 2 of the CB (17164-BA03) to the OFF and No. 3 - 8 to the ON position.

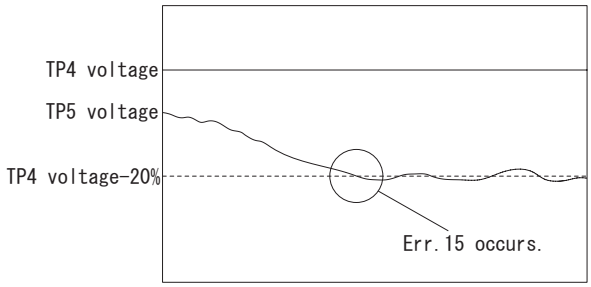
2. Turn OFF the master and key switches. Set the oscilloscope to the terminals below and turn ON the master and key switches.
CH1: TP5 on the MASTER BOARD (17164-BA01)
CH2: TP4 on the MASTER BOARD (17164-BA01)

3. Turn VR6 on the MASTER BOARD (17164-BA01) to match the TP4 voltage with the TP5 voltage when emitting the laser.
* The TP5 voltage on the MASTER BOARD (17164-BA01) is fixed.

4. Set the POWER display of the CB to "50mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP4 voltage becomes the TP5 voltage + 20%. Adjust the value of parameter address 56 so that INTLK 2.7 (only a beep) occurs at that time. (See 7.1.)



5. Set the POWER display of the CB to "50mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP4 voltage becomes the TP5 voltage -20%. Adjust the value of parameter address 59 so that Err. 15 (only a beep) occurs at that time. (See 7.1.)



6. Turn VR6 on the MASTER BOARD (17164-BA01) to match the TP4 voltage with the TP5 voltage when emitting the laser.

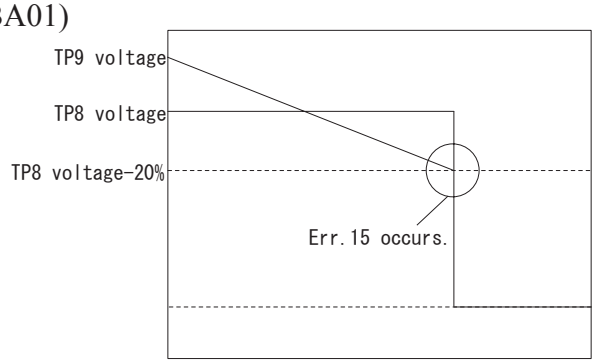
7. Set all DIP switches of the CB (17164-BA03) to the ON position.

7.6.4 Check of overpower

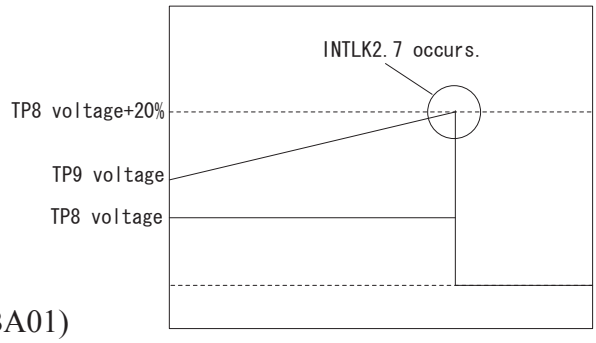
1. Set all DIP switches of the CB to the ON position.

2. Turn OFF the master and key switches. Set the oscilloscope by following the instructions below and turn ON the master and key switches.
CH1: TP9 on the MASTER BOARD (17164-BA01)
CH2: TP8 on the MASTER BOARD (17164-BA01)

3. Set the POWER display of the CB to "1000mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP8 voltage becomes the TP9 voltage -20%. Verify that Err. 15 occurs (laser emission is OFF, as well) at that time.

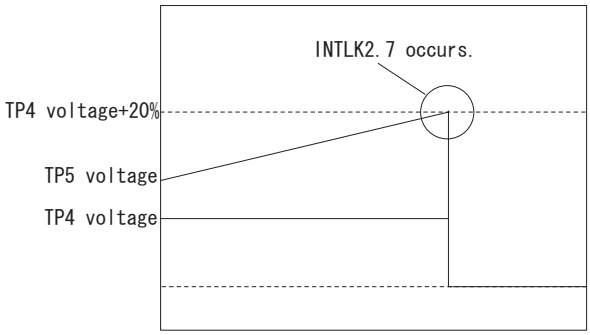


4. Set the POWER display of the CB to "1000mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP4 voltage becomes the TP5 voltage + 20%. Verify that INTLK 2.7 occurs (laser emission is OFF, as well) at that time.

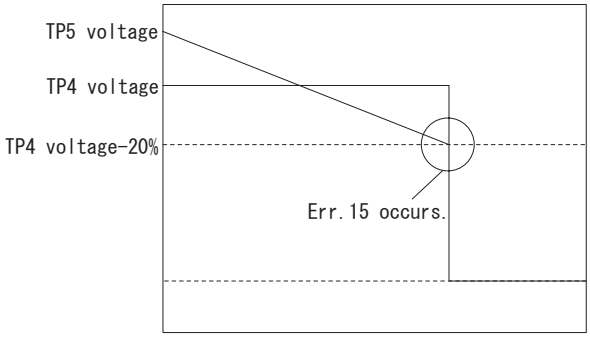


5. Turn OFF the master and key switches. Set the oscilloscope to the terminals below and turn ON the master and key switches.
CH1: TP5 on the MASTER BOARD (17164-BA01)
CH2: TP4 on the MASTER BOARD (17164-BA01)

6. Set the POWER display of the CB to "50mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP4 voltage becomes the TP5 voltage + 20%. Verify that INTLK 2.7 occurs (laser emission is OFF, as well) at that time.



7. Set the POWER display of the CB to "50mW". While emitting the laser, turn VR6 on the MASTER BOARD (17164-BA01) so that the TP4 voltage becomes the TP5 voltage -20%. Verify that Err. 15 occurs (laser emission is OFF, as well) at that time.



8. Turn VR6 on the MASTER BOARD (17164-BA01) to match the TP4 voltage when emitting the laser with the TP5 voltage.

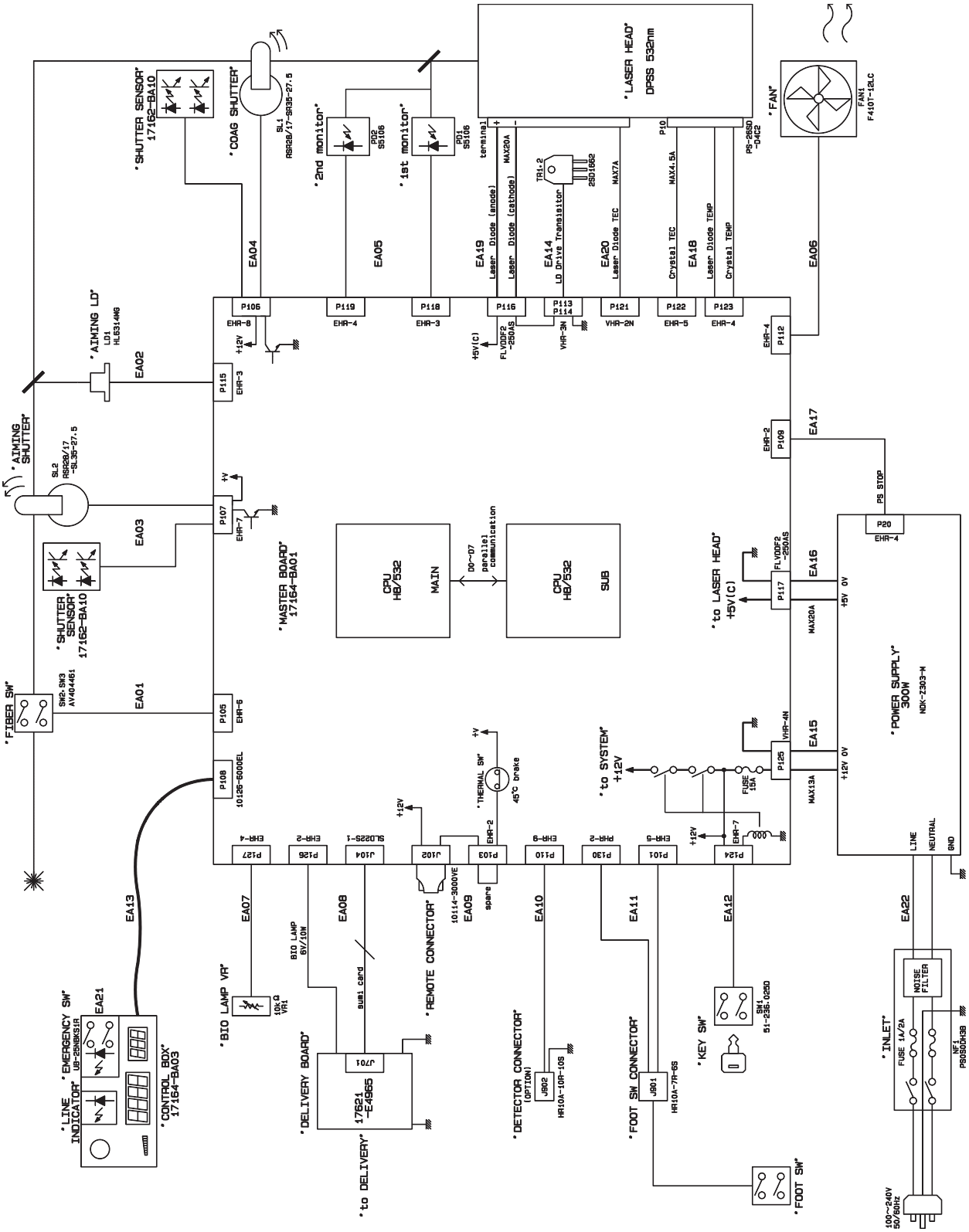
9. After the adjustment is completed, verify with the oscilloscope that the waveforms at the powers of 50 - 1700mW match.

7.6.5 Adjustment of the COAG TIME and REPEAT TIME

1. Set the analyzing recorder (Model 3565) to the instrument.
2. Set the POWER display of the CB to "250mW" and TIME display to "0.01 sec".
3. Emit the laser and adjust the value of parameter address 52 so that the measured value (COAG TIME) by the analyzing recorder becomes 0.01 sec. (See 7.1.)
4. Verify that the COAG TIME is within the specified range when the TIME display of the CB is set to 0.02 - 3.00 sec.
[Specification of COAG TIME]
0.01 - 0.09 sec: TIME display of the CB ± 20%
0.10 - 3.00 sec: TIM display of the CB ± 10%
5. Set the REPEAT TIME display of the CB to "0.1 sec".
6. Emit the laser and adjust the value of parameter address 53 so that the measured value (REPEAT TIME) by the analyzing recorder becomes 0.1 sec. (See 7.1.)
7. Verify that the REPEAT TIME is within the specified range when the REPEAT TIME display of the CB is set to 0.2 - 1.0 sec.
Specification of REPEAT TIME: REPEAT TIME display of the CB ± 10%

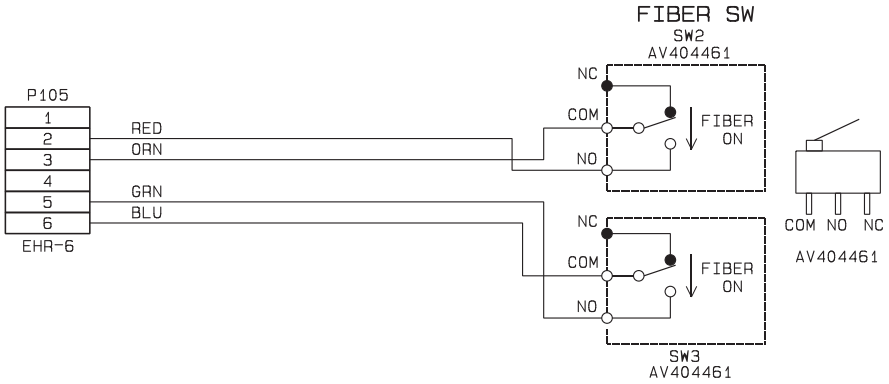
§8 REFERENCES

8.1 Wiring diagram

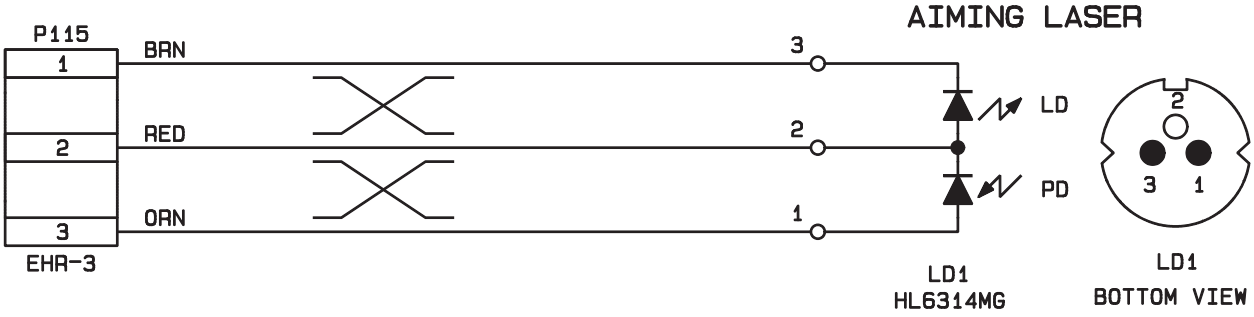


8.2 Connectors and cables

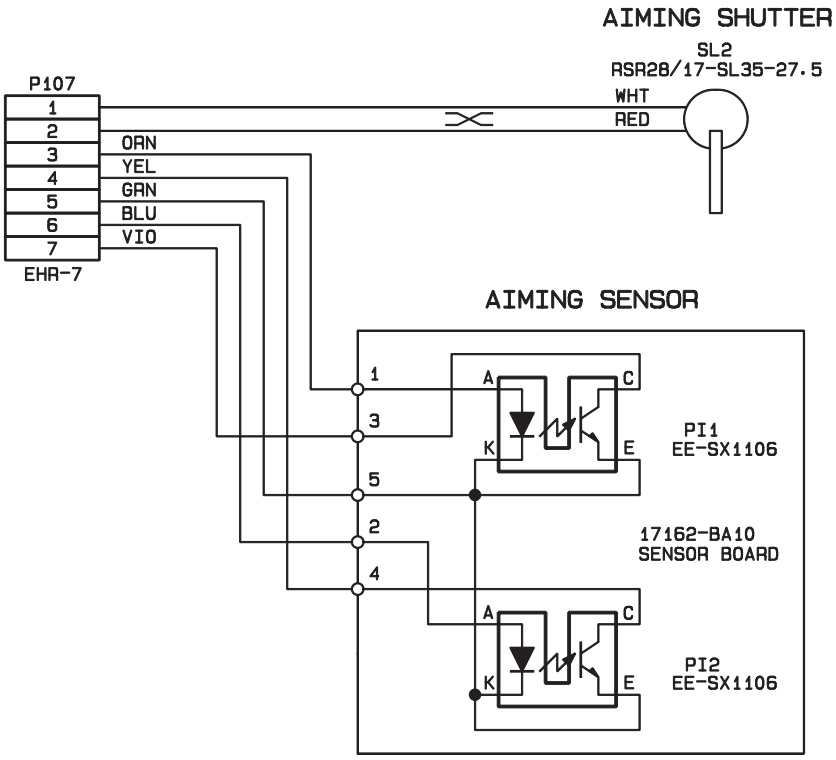
17164-EA01



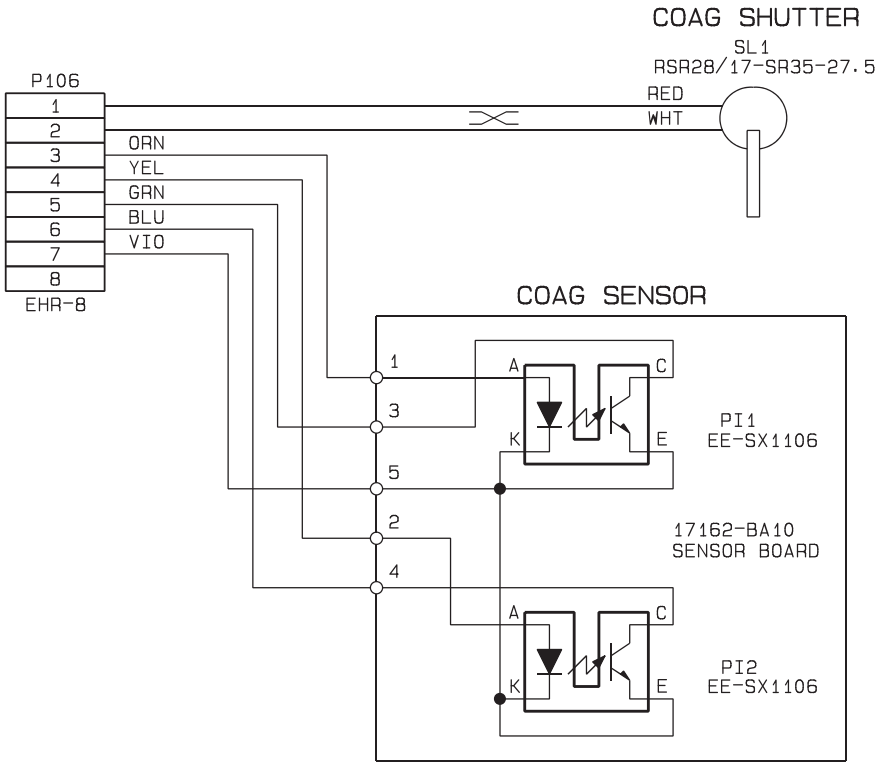
17164-EA02



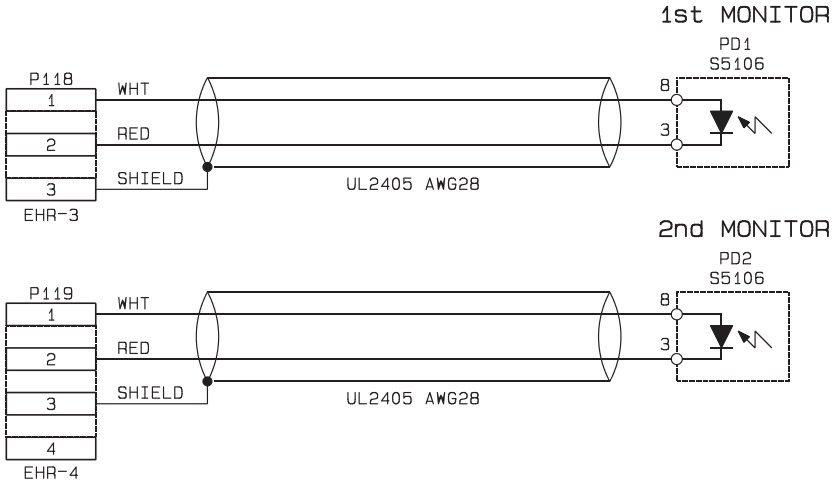
17164-EA03



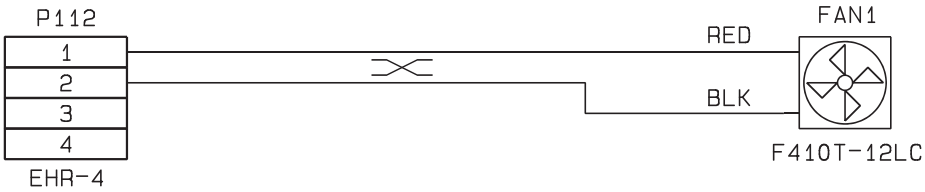
17164-EA04



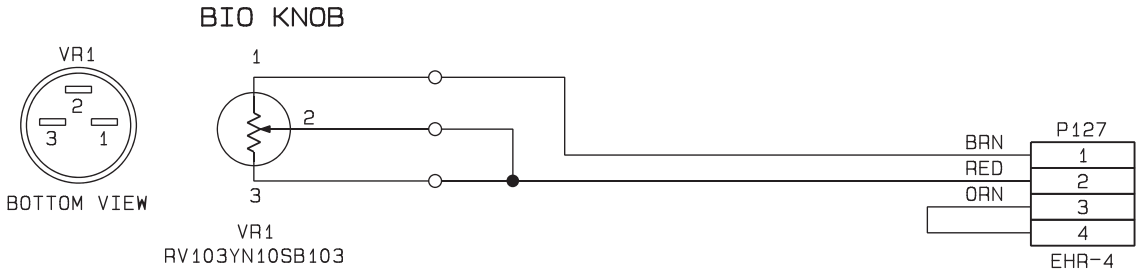
17164-EA05



17164-EA06



17164-EA07



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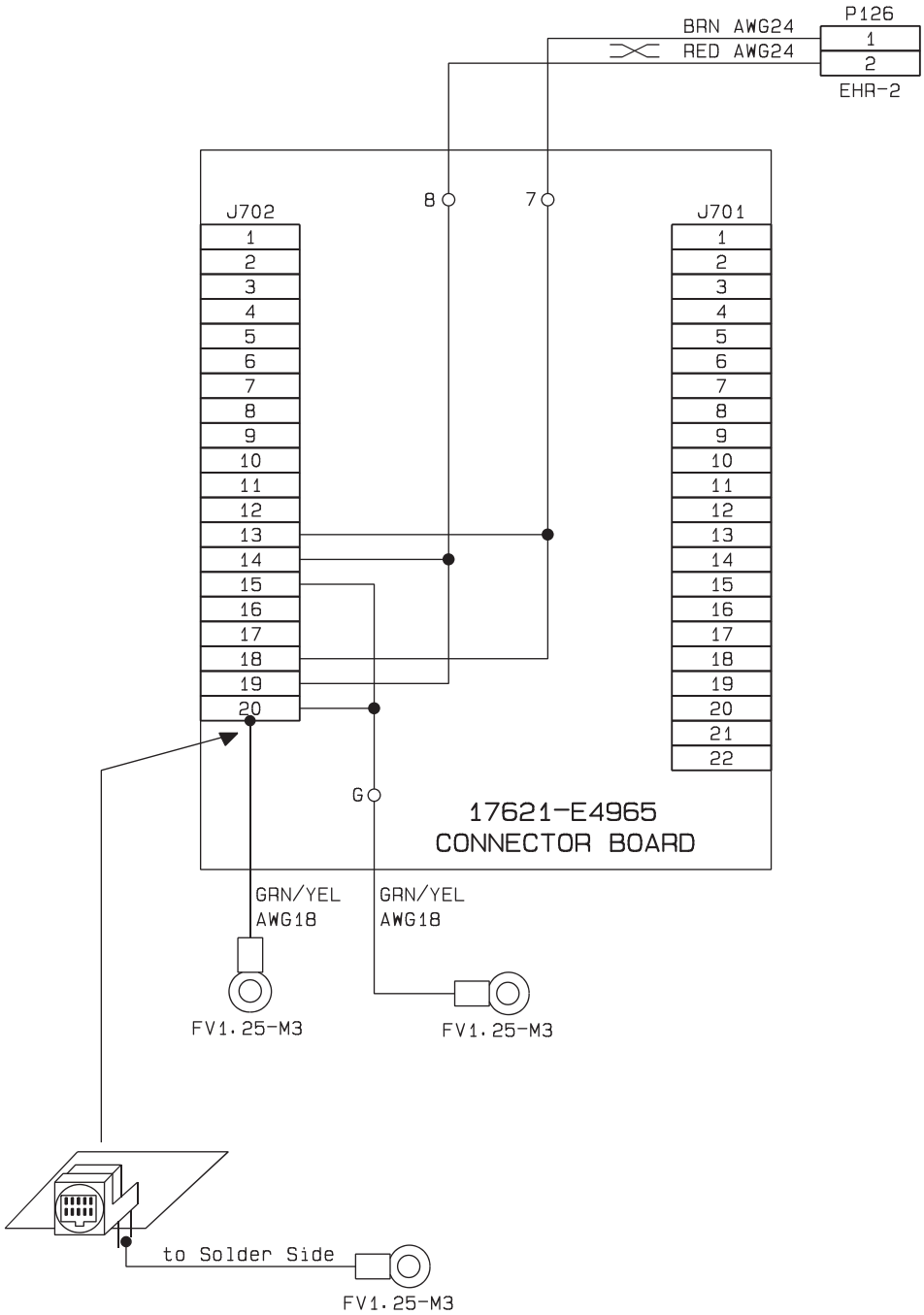
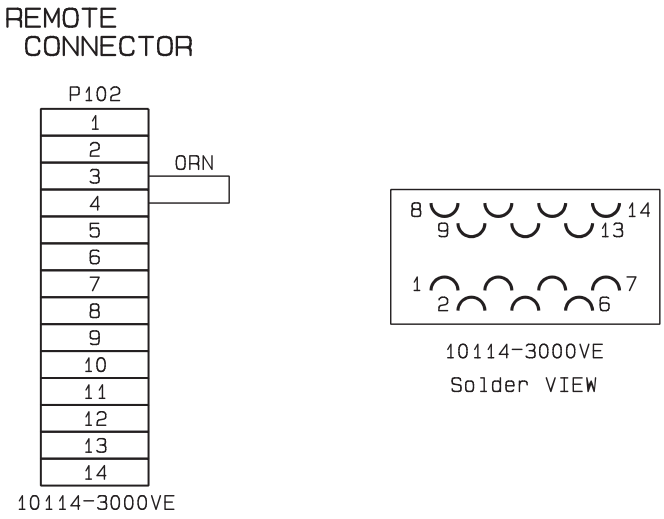
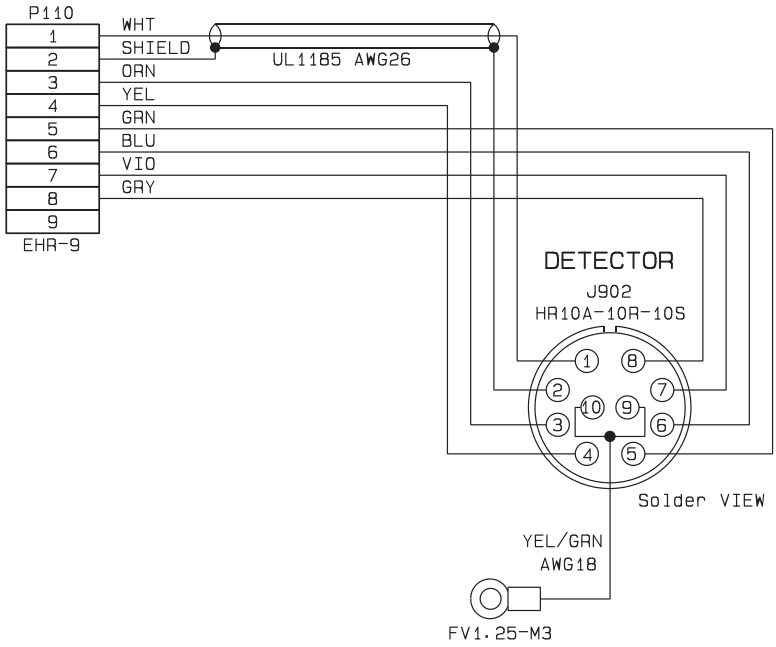


17164-EA09



17164-EA10



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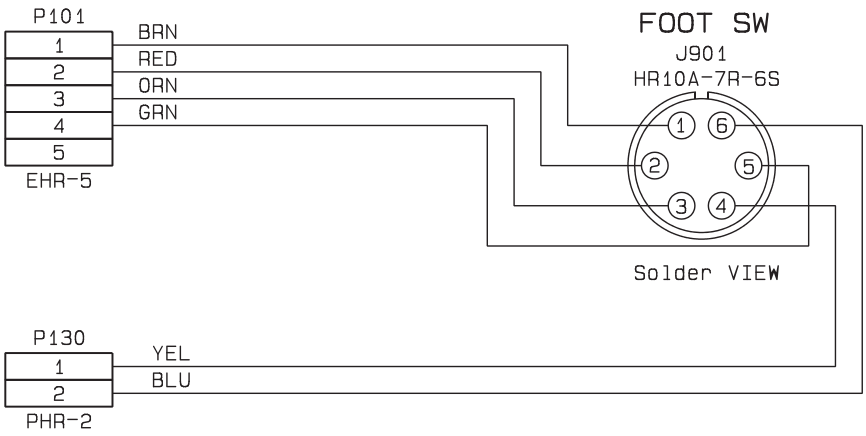

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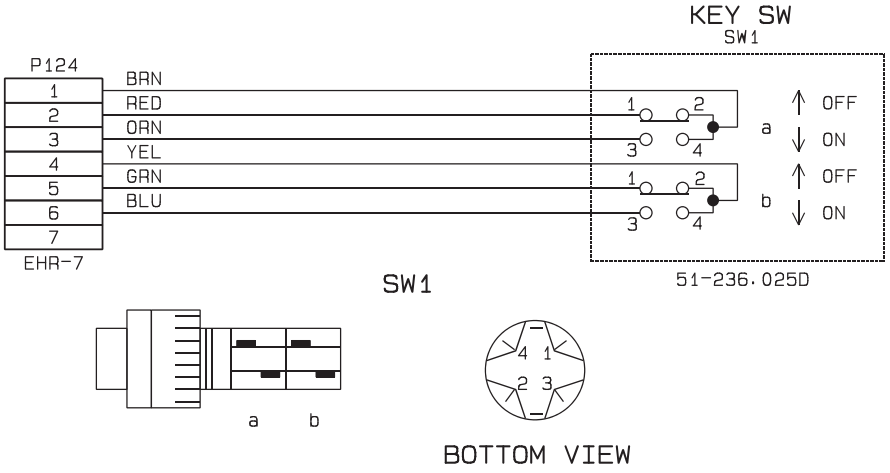

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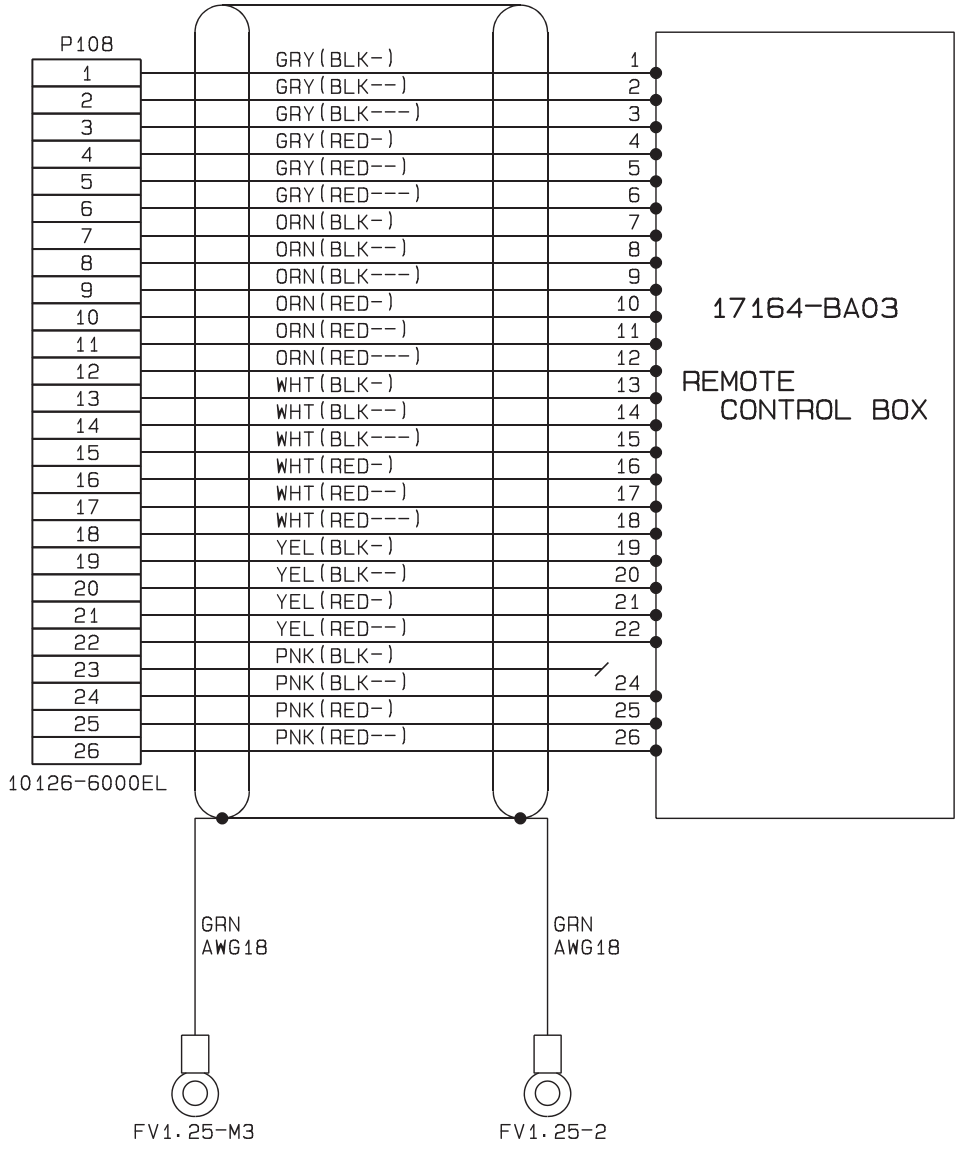
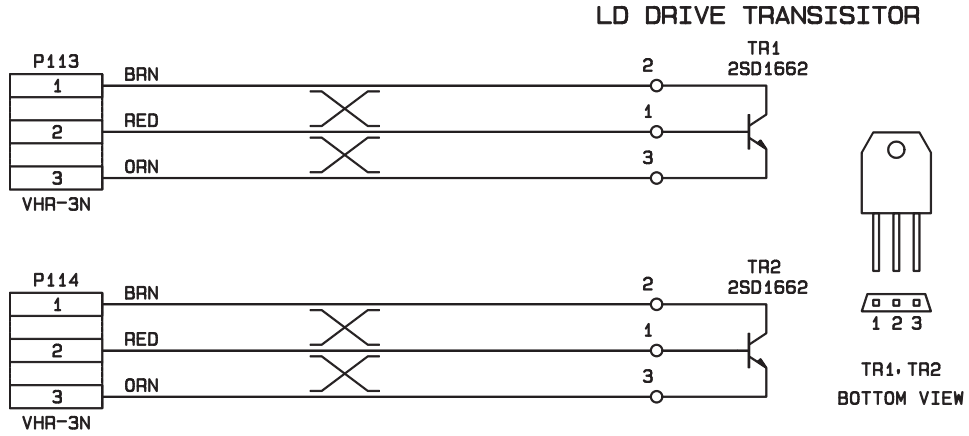


17164-EA14



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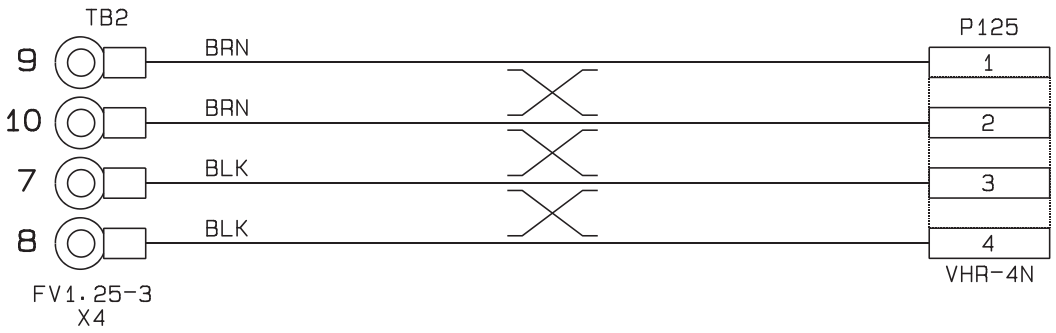

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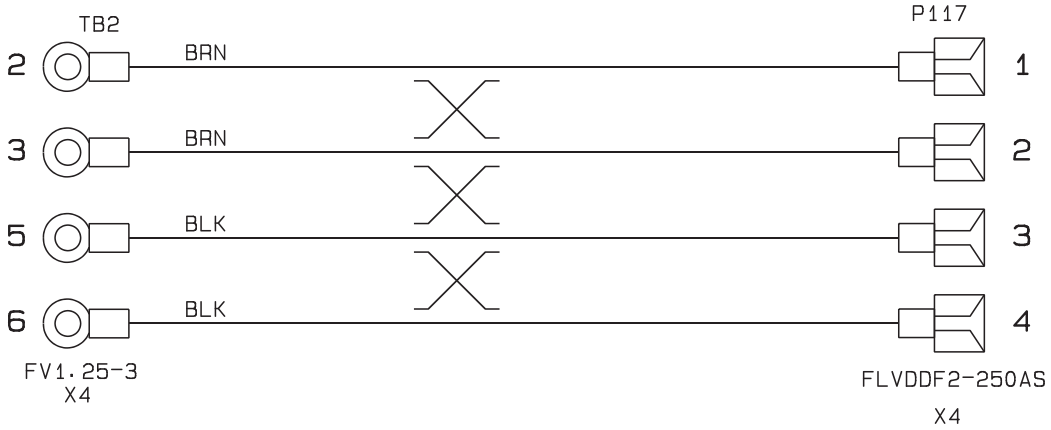

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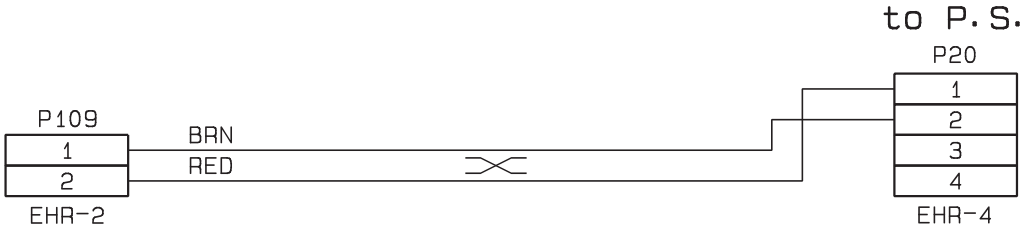

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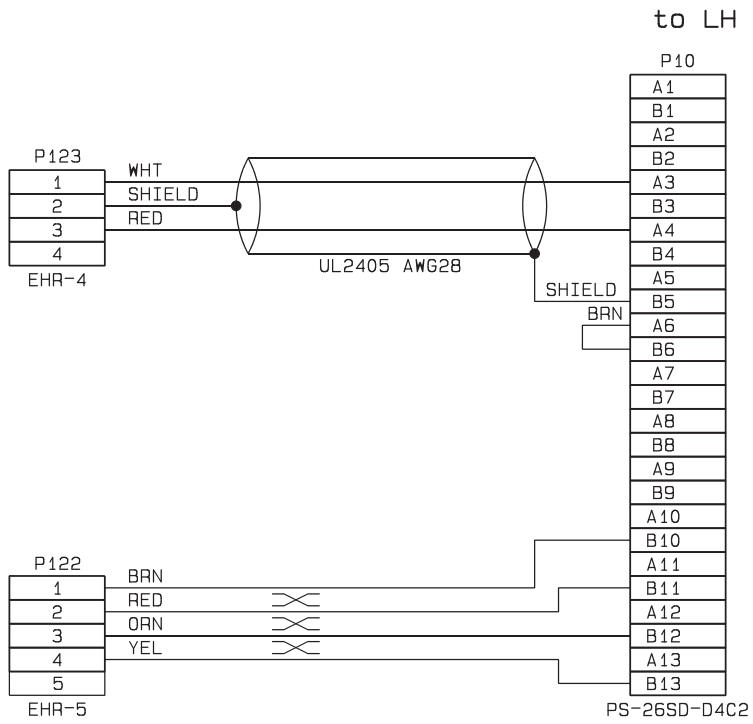
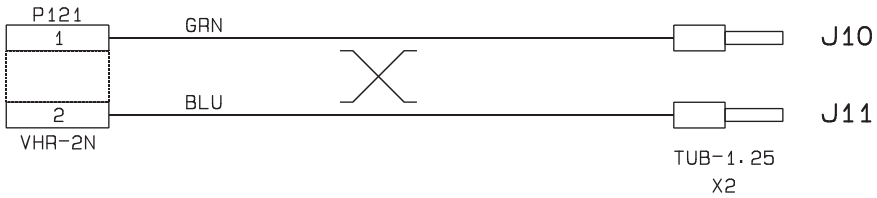


17164-EA19

17164-EA20



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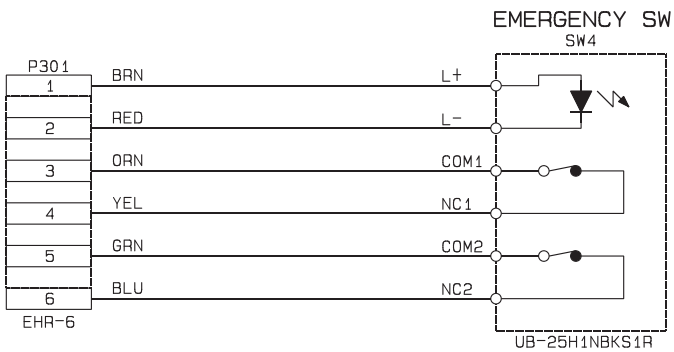

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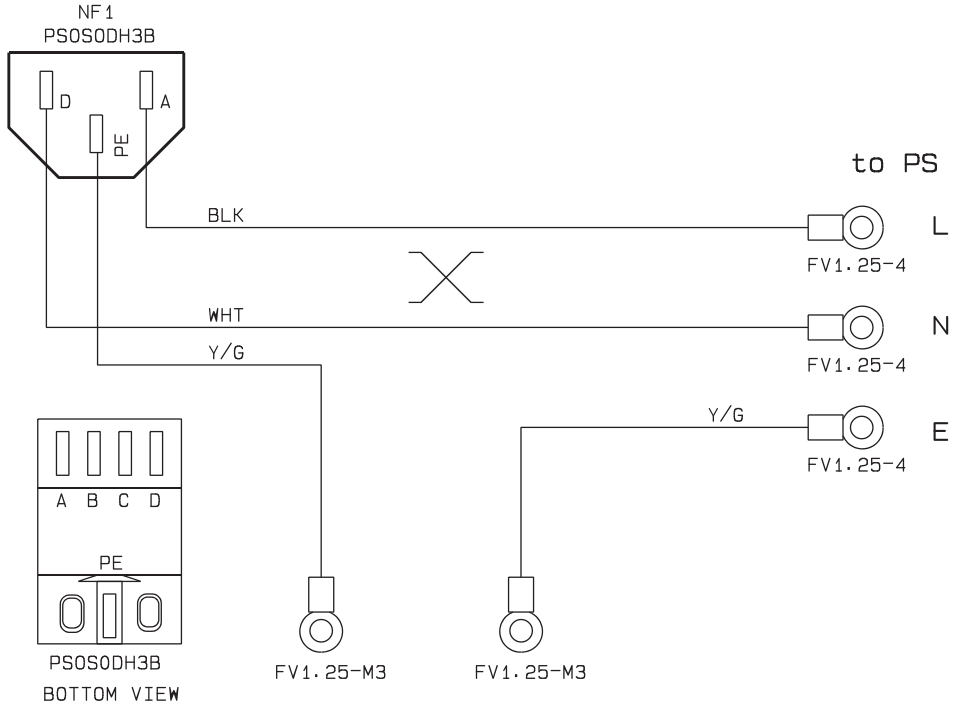
NF1
PSOSODH3B
D
A
PE
to PS
BLK
L
FV1.25-4
WHT
N
FV1.25-4
Y/G
Y/G
E
FV1.25-4
A B C D
PE
PSOSODH3B
BOTTOM VIEW
FV1.25-M3
FV1.25-M3

8.5 List of the replacement parts

Name of part	Part No.
Switching power supply	17164-E010
MASTER BOARD	17164-BA01
FAN	17164-EA06
COAG SHUTTER ASSY	17164-1310
SENSOR BOARD	17162-BA10
AIMING SHUTTER ASSY	17164-1320
Laser ASSY	17164-1000
LASER HEAD	17164-G001
FIBER SW	17164-EA01
MAIN CPU	17164-E150
SUB CPU	17164-E160
CB CABLE	17164-EA13
AIMING LD	17164-EA02
DELIVERY board	17164-BA08
MONITOR ASSY	17164-1200
EMERGENCY SW	17164-EA21

8.6 Tools

- Set of Phillips screwdrivers
- Set of flat-head screwdrivers
- Blower
- Thin stick (chopstick)
- Hex wrench
- Needle nose pliers
- Nipper
- Wire stripper
- Soldering iron
- Tweezers
- Set of precision screwdrivers
- Industrial screwdriver
- Multimeter
- Oscilloscope
- Lens cleaning paper
- Alcohol solution
- Thread-locking adhesive
- Heat shrinkage tube
- Japanese special paper (Gampi-shi)
- Solder

8.7 DIP switches

No.	Operation	Contents
1	Interlock cancellation	Interlock detection is canceled. (However, laser emission is stopped by hardware when INTLK occurs.)
2	Error cancellation	Error detection is canceled*1)
3	Not used	
4	Switching between Current and Light modes	Current control mode (OFF) or Light control mode (ON) of laser emission can be selected.
5	Continuous emission mode	Laser emission time can be set to the Continuous mode.
6	Parameter setting mode	Each parameter can be set.
7	Not used	
8	Service mode	Supplied current, etc. to the laser head can be indicated.

*1) To avoid unintended laser emission and deterioration of the laser, Err 13, Err 20 and Err 21 occur even when the error detection is canceled.

8.8 Error code table

Err	Symptom	Causes	Countermeasures
1	The COAG shutter does not work properly.	Malfunction or improper position of the COAG shutter	Check the motion of the shutter. Check the position of the sensor.
2	The motorized protective filter does not work properly.	Malfunction or improper position of the motorized protective filter	Check the motion of the motorized protective filter. Check the position of the sensor. Check the DELIVERY connector. Check the parameter setting for the delivery unit.
3	The safety shutter does not work properly.	Malfunction or improper position of the safety shutter	Check the motion of the shutter. Check the position of the sensor.
10	The laser goes out.	Deterioration of the green laser	Replace the laser. Check the laser control signal cables P116 to P119.
13	L/D driving circuit is abnormal.	Failure of the L/D current driving circuit (Tr1, 2)	Check or replace Tr1 and Tr2.
15	Power output is unstable.	Unstable power output of the green laser	Readjust the detection of underpower.
20	L/D temperature is abnormal.	Malfunction of the L/D temperature controlling unit	Repair the broken cable between the LD sensor and P123. Repair the failed controlling circuit on the BA01 board.
21	Temperature of the green laser head is abnormal.	Malfunction of the green laser head temperature controlling unit	Repair the broken cable between the LH sensor and P123. Repair the failed controlling circuit on the BA01 board.
53	Trigger signal circuit is abnormal.	Failure of the trigger switch Broken cable	Check for breakage of the foot switch. Readjust the position of the micro switch.
54	Fiber optics signal circuit is abnormal.	Failure of the fiber switch Broken cable	Reconnect the fiber optic cable plug. Check and adjust the position of the micro switch.
55	Motorized protective filter signal circuit is abnormal.	Failed sensor of the motorized protective filter Broken cable Improper setting	Reconnect the delivery unit to the DELIVERY connector. Check and adjust the sensor position of the motorized protective filter.
90	Program data is abnormal.	Contents of the ROM are rewritten.	Replace the CPU.
91	EEPROM data is abnormal.	Contents of the EEPROM are rewritten.	Cancel the error, and input the data again.
93	Data error	Data in the memory is abnormal.	Cancel the error, and input the data again.
94	KEYLOCK error	Improper motion of the program	Replace the CPU.
95	SUB CPU error	Malfunction of the SUB CPU	Replace the SUB CPU.

8.9 INTERLOCK code table

No.	Symptom	Causes	Countermeasures
2.7	Overpower	Overpower of the laser	Readjust the detection of overpower. Repair broken cable P118. Repair the failed BA01 board.
4.7	The system is heated.	The inside of the system is overheated.	Turn OFF the master switch for about 1 hour for cooling.
6.3	Remote interlock is OFF.	The remote interlock connector is not connected, or remote interlock switch is open.	Connect the remote interlock connector.

8.10 Other messages

Following abbreviated messages appear on the TIME display when the key operation is improper.

Message for improper operation	Causes	Countermeasures
A.P.	The STATUS switch is pressed when the aiming beam is OFF.	Turn the aiming beam ON.
F.S.	The AIMING switch is pressed when the fiber-optic cable is not connected.	Connect the fiber optic cable.
S.U.	The AIMING switch, etc. is pressed when the delivery or delivery mirror is not positioned where the laser can be emitted.	Check the position of the delivery or delivery mirror.
S.S.	The foot pedal is depressed when the “STANDBY” indication is lit up.	Press the STATUS switch to change the indication to “READY”.
P.F.	The foot pedal is depressed when the motorized protective filter is not set.	Set the protective filter.
	The AIMING switch is pressed when a delivery unit without the motorized protective filter is connected.	Connect a delivery unit with the protective filter.

8.11 Special key operations

Function	Key operation
Adjusting the laser power output	Turn ON the key switch while holding down the AIMING switches (△, ▽) and STATUS switch simultaneously. Setting of the laser power output becomes possible. Green laser power output Offset: Address 18 Gain: Address 20 – 29 (It varies according to the delivery unit.) AIMING laser power output Offset: Address 19 Gain: Address 17 [NOTE] Only values of the parameter addresses 17 – 29 can be changed.
Displaying the archival record of the instrument Displaying the total shot numbers Recording the Error Recording the Interlock	Turn ON the key switch while holding down the INTVL and STATUS switches simultaneously. Every pressing of the RESET switch changes the following indications. Total shot numbers: Number on the POWER display × 1000 shots Latest occurred Error No. Latest occurred Interlock No.
Emergency mode (Laser can be emitted even when the detective signal for the motorized protective filter and delivery unit is improper.)	Turn ON the key switch while holding down the POWER switches (△, ▽) and STATUS switch simultaneously. [NOTE] Use this mode only when operation cannot be continued due to a broken signal cable, etc. Give the operator instructions to check the protective filter and proper installation of the delivery unit adequately.

* Specifications and design are subject to change without notice for improvement.

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